University of Bath

PHD

Job design and new technology: an investigation into the effects of new technology on people's jobs and the contribution of job design to its effective introduction

Bailey, John

Award date:
1989

Awarding institution:
University of Bath

Link to publication

Alternative formats
If you require this document in an alternative format, please contact:
openaccess@bath.ac.uk

Copyright of this thesis rests with the author. Access is subject to the above licence, if given. If no licence is specified above, original content in this thesis is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC-ND 4.0) Licence (https://creativecommons.org/licenses/by-nc-nd/4.0/). Any third-party copyright material present remains the property of its respective owner(s) and is licensed under its existing terms.

Take down policy
If you consider content within Bath's Research Portal to be in breach of UK law, please contact: openaccess@bath.ac.uk with the details. Your claim will be investigated and, where appropriate, the item will be removed from public view as soon as possible.

Download date: 05. May. 2023

JOB DESIGN AND NEW TECHNOLOGY

An investigation into the effects of new technology on people's jobs and the contribution of job design to its effective introduction.

Submitted by John Bailey for the degree of Phd of the University of Bath, 1989

Copyright: Attention is drawn to the fact that copyright of this Thesis rests with its author. This copy of the Thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with its author and that no quotation from the Thesis and no information derived from it may be published without the prior written permission of the author.

This thesis may not be consulted, photocopied or lent to other libraries without the permission of the author for 10 years from the date of acceptance of the thesis.

UMI Number: U601747

All rights reserved

INFORMATION TO ALL USERS
The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript
and there are missing pages, these will be noted. Also, if material had to be removed,
a note will indicate the deletion.

UMI U601747
Published by ProQuest LLC 2013. Copyright in the Dissertation held by the Author.
Microform Edition © ProQuest LLC.
All rights reserved. This work is protected against
unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

UNIVERSITY OF BATH
LIBRARY
21 MAY 1990
PHD
S042215

SUMMARY

This research has been about the impact of computer based technology on peoples' jobs and what contribution research, in the field of job design, can make in its effective introduction. In what has often been described as the second industrial revolution, do the advantages of computer based technology have to be at the expense of people and their sense of involvement and satisfaction? What contribution can job design make on the introduction of these new systems and what are the conditions in which effective job design can apply?

To answer these questions, I conducted a literature survey and field research into six cases. These cases included both blue and white collar situations in manufacturing and service industries. Each case involved the introduction of computer based systems of manufacturing or information.

The evidence from my research shows that, while the effects on people and their jobs can often be negative, this need not necessarily be so. Changes in technology provide unique opportunities for change in the management and organization of work and the participation of people in the planning process. However, whether this is done or not, depends largely on the assumptions of management and their involvement in planning the changes. The evidence shows that where people adopt a socio-technical perspective, recognizing that the technical changes require changes in attitudes, organization and management processes, it is possible to realise the full potential of both people and technology. However, achievement of these conditions may imply changes in the culture of the organization itself in order to maintain its effectiveness in today's complex and challenging environment.

ACKNOWLEDGEMENTS

On completion of my thesis, I would like to acknowledge the tremendous help I have received from all the people who have given me their time and interest during my research. It would be impossible to mention all individuals by name because, apart from members of management, supervisors, technologists, consultants and advisors, there have been many people on both the shop and office floors of the different companies I have visited, who have been willing to give me their frank and honest opinions, which I have valued and respected.

However, on a personal level, I would particularly like to thank people like Peter Holmes and the late Jenny Blake, and Dennis Pheysey who encouraged me to get into this research.

I would also like to thank my colleagues at the Polytechnic, such as Harry Rothman, Mike Beeby and Irving Rogers for their interest, and the Polytechnic Research Committee for its practical and financial support.

My especial thanks however must go to Geoffrey Hutton, who has been a constant source of encouragement and inspiration.

Finally, my thanks must also go to Barbara Gibbons for her patience and persistance in typing the many drafts and the final thesis.

CONTENTS: **PAGE NO.**

CONTENTS: **PAGE NOS.**

APPENDICES

List of Figures

PART I

THE FORM OF THE RESEARCH

CHAPTER 1 - FIELD, ORIGINS AND APPROACH

As a one time Personnel Manager and Management Consultant in industry, I have always been interested in the involvement of people at work. This interest has continued into my current role as a lecturer, researcher and training consultant. I have always believed and found much evidence to support the notion that the effective involvement of people at work can do much to enhance not only their job interest and satisfaction, but also the effectiveness of the firm or organization for which they work. This issue and the effective utilization of people assumes an even greater importance in today's circumstances of increasing cost constraints. Management have faced the continuing challenge of achieving their objectives with fewer people while still retaining the goodwill and the commitment of the staff involved.

In the 1950's and 1960's concern amongst management for productivity and participation led to significant experiments and developments in terms of the design of peoples' jobs and organization of work. These initiatives contrasted with previous phases and strategies such as work study and industrial engineering in that they took the human factor and peoples' motivation and needs into account as well as economic and technical considerations. Also, in comparison to the developments in ergonomics which was largely confined to the physical factors associated with people, job design looked further to incorporate peoples' psychological and social needs into the design and organization of their work. This movement, which has been well documented, (see my own book, Bailey 1983) culminated in the late 1970's when the recession diverted managements' attention from longer term developmental strategies to shorter term cost cutting and survival tactics. However, while initiatives and innovations such as job design might have suffered in that type of climate this was not before some quite impressive results and benefits had been recorded from these innovations, so that what may have originally been seen by many managers as one of the latest managerial techniques such as JIT or Quality Circles, job design has now become accepted by many people as sound management practice that should be incorporated in the management processes of any organization.

During the late 1970's and 1980's management have increasingly been looking to new technology, particularly in the form of computers for information technology and automated manufacture, as the means of increasing efficiency and maintaining competitiveness in an ever more competitive world. Thus, we have seen on an increasing scale, the rapid introduction of computerized systems for management information and control in offices and computer assisted systems of manufacture on the shop floor. These innovations have largely been dominated, not surprisingly, by technical and economic considerations and their effect on people and the quantity and quality of the employment afforded has more often than not been a secondary consideration. In what is therefore a major swing away from social and human considerations of organizational effectiveness to the dominance of economic and technical considerations one must ask what effect this has had on people and their sense of involvement and satisfaction and further than this what is the effect of these issues on the ultimate survival of the enterprise.

In what has by many people been described as the second industrial revolution are we making the same mistakes again? Does the application and introduction of computerized systems of information and manufacture, as with mechanisation in the previous industrial revolution, necessarily mean fewer and less interesting jobs? Do we have to accept the implications of what has been described as *technological determinism* (Davis and Taylor 1979) or are there options and alternatives in the disposition of people and technology? What relevance have the concepts and approaches of job design and work organization to the new situation and how could they be applied in practice? How adequate are current perspectives and theories to the challenge presented by the new technological age?

While this research has in one sense a narrow focus, namely the design and organization of peoples' work in automated and computerized settings, it is linked with and draws on many functions and disciplines associated with the management of organization. From a management point of view the introduction of these new systems is related to the strategic development of the organization as well as its operational effectiveness. Thus, the reasons why management introduce new technology is likely to have considerable influence over the way it is introduced and

potentially to relative roles of people and technology in the new systems. Similarly, the industrial relations climate and traditions of the organization will influence the manner in which technology is introduced and the degree of employee and trade union influence and participation in the process. Production engineers and system analysts in their role as system designers are acting as change agents in the introduction of new technology and therefore their perspectives and values are likely to heavily influence the design of the system and the relative consideration given to economic, technical and social factors. For example, we need to recognise that changes in computer design from mainframes to mini- and micro- computers have opened up options and alternatives in terms of organization design that would not have been possible in the past. Mention has already been made of techniques such as work study, industrial engineering and ergonomics all of which have relevance to the design of a manufacturing or information processing systems.

However, it is the developments in thinking about job design and work organization that are most pertinent to this research and in this regard the recognition that we are dealing with what is essentially a socio-technical system is central to the field of study. The work of the Tavistock Institute and the development of socio-technical systems theory with its overall perspectives and criteria for effective job and work group design has provided the initial conceptual framework in which this research is set (Trist 1981).

Decision to engage in research

Encouragement to investigate this area and the implications of the introduction of new technology came from my own boss, then Head of the Regional Management Centre in the early 80's. At this time I was still very much involved with job design and my initial reaction was mixed because while I recognised its significance, I had some anxiety over my lack of knowledge and understanding of computers. This factor and the fact that many people do not understand and are fearful of computers maybe one of the reasons why technology dominates so much in the introductory phase.

A further feature that unsettled me and tipped me into action was when one of my colleagues in the computing department asked me to speak at a research seminar on the impact of the computer on the nature of peoples' work and I realized with some concern that I really did not know the answer to this important question and could not, with authority, speak at the seminar.

At the time I was also engaged in writing my book on Job Design and Work Organization (Bailey 1983) and from discussion with colleagues in the field and the comments of the reviewers on my proposed book it became evident that this was a development I must address and was perhaps the major issue in the field of job design and work organization in the current decade.

I had the opportunity as a member of the Association for Teachers of Management to register on the research training scheme for teachers of management at Aston University Management Centre. This formed an invaluable opportunity to explore the issues involved in undertaking this type of research and some of the possible methods involved. It was my involvement on this scheme which helped me to formulate my proposal for the research and to register it with Bath for a Phd.

Research objectives

The objective of the research was therefore to explore the contribution of job design concepts and approaches to the effective introduction of new technology and specifically:

1. How far can human factors and peoples' needs be taken into account in the design of computer automated systems and of information and manufacture without jeopardising the technical integrity and economic effectiveness of these systems?

2. What role can job design play in the design and implementation process and how appropriate and adequate are the models and instruments available? Is it possible to create a situation in which the needs of both people and technology can be met and how can this be achieved to the satisfaction of those concerned?

3. Why is it when evidence exists of the negative consequences of the arbitary application of computer systems of automation and information, that management fail to utilize the knowledge that already exists in terms of job design and work organization?

4. What are the factors that need to be considered when introducing new technology and what are the constraints and opportunities that will influence its effective implementation? What form should a strategy take for achieving these aims?

Research approach

My approach was developed during the formative early stages of research, especially my study of the literature. The early stages enabled me to clarify not only what I wanted to study, but how I would go about it. Whereas I had started out with a concern to establish the effects of computer systems on job content and satisfaction, my enquiries, my own hunches and my experience suggested that there was much more to it than that. While investigation at the level of the impact of technical change on the individual, the content and design of their jobs was clearly relevant, a number of other issues and factors would be involved. Thus, in conducting my field work I would need to look at factors such as strategy, structure, the role of management and of supervision, communication, and participation in the design and introductory process. Thus, the focus and the level of the research at which data was obtained would have to reflect these factors. Similarly, the perspective of the research would have been sufficiently broad to take all of these variables into account.

While my initial investigations had influenced my thoughts regarding the level of the research and the number of variables to be encompassed, it had also influenced my ideas about the process to be employed. It was clearly going to be very important to study the actual process by which technological change was introduced. The objectives, the motives, the needs and expectations of all the parties involved would influence the final outcome and balance of the factors and variables involved.

All of this suggested that the research would be more fruitful and get nearer the truth if it was based on case studies with as much intimate involvement on my own part as possible. This approach, as opposed to the statistically based survey type research was, in my view, likely to provide much richer evidence of the issues involved. It also fulfilled my own need to get out and get in there and see for myself what it was all about.

While this was my own preferred strategy and method, it could be challenged in some quarters as being less rigorous and lacking in direction. Certainly , my experience of the Aston School of Research was of an almost mechanistic, structural and statistical approach which did not appeal to me and seemed to preclude the essential human and social nature of the process. Thus, I opted for a more inductive, qualitative approach where I, myself, with my own beliefs, knowledge, interests and experience, was the main research instrument collecting and analysing the data through my own perspectives.

This approach is well founded and is based on the ideas expressed in 'grounded theory' Glazer and Strauss (1967) which I had been impressed with when studying approaches and research methodology. This approach, rather than closing off views and aspects of the investigation, opens up potentially relevant issues.

Concern for the process of change also meant that wherever possible one would undertake a 'longitudinal study' rather than a 'snapshot' at a particular point in time, although the opportunities for doing this are more limited and there are risks involved.

In all the strategy adopted was perhaps a relatively high risk strategy. Problems might be expected in obtaining the necessary access and the freedom to obtain the required information. In the event, through the good offices of my colleagues, existing and new contacts, I was able to gain access for depth investigations in six different, but complementary situations. This was achieved from a continuous process of scanning for suitable cases and illustration. I made contact with a number of different organizations often involving visits and detailed discussions which were all informative

in relation to the research. However, the cases selected were chosen because they provided the best opportunities for my involvement and illustrated particular points in relation to my overall thesis.

My own role in each of the cases varied considerably with the circumstances concered. In some cases I acted as an interested observer, in others as an expert in job design. In some situations I was in the role of action researcher, whereas in others I acted as a consultant. However, in each situation, having negotiated a role, I was able to collect the type of data I needed for the purposes of my research and my faith in the approach I adopted has been borne out in practice.

Connection with current work

Two activities in my current work have influenced my thinking and approach to the research.

The first of these has been my continuing interest and in volvement in running a specialised option course for the Diploma in Management Studies. Initially this course was on Job Design, but more recently, increasing interest in computers and their application has meant that the emphasis and title of the course has shifted to Job Design and New Technology. This has provided an annual opportunity to review my own thinking and findings in this area with a group of informed and interested students.

Apart from discussion and input on the theories and concepts of job design and work organization we take the opportunity to visit a number of organizations. Here we see the issues of work organization and the impact of new technology at first hand and as a result semi-structured observations on the part of ther students, share and exchange our findings and impressions following these visits. In addition we also have inputs and discussion from trade unionists, managers and specialists on factors such as stress and new technology, new technology agreements and the development of advanced manufacturing systems.

This course, apart from providing an occasion to take stock of the '*state of the art* ' in this field has also provided some valuable contacts, field visits and research sites and I took the opportunity to write up what we do and some of the impressions I have gained in the form of an article that was subsequently published in Industrial and Commercial Training (Bailey 1980).

In this, I described our impressions following some visits to a Computerised Order Entry System at Coca Cola, to CAD applications at British Aerospace to a Flexible Manufacturing System at Crewkerne. In each case, while there may have been some negative consequences, eg in terms of loss of variety or increased pressure from working with a VDU, the general reaction to the new technology appeared to be favourable. People enjoyed the challenge of the new equipment and appreciated its ability to enhance their own efficiency and effectiveness. In these cases and at the FMS at Crewkerne in particular, there was evidence that it had been possible to combine the needs of the technology and those of the people with a degree of success and far from the '*gloom and doom* ' people often say is associated with its introduction, a very positive and optimistic view seemed to be emerging.

The second important influencing factor in conducting this research has been my involvement with the International Association of Management Institute and the European Institute of Scientific Management, IASM, who have hosted a bi-annual international conference focussing on New Technology and the management, organizational and cultural issues in its introduction.

This has provided me with an invaluable opportunity to present papers based on my own research, to obtain reactions from others in the field and to keep abreast of research and publications in this field on an international basis. My papers for these conferences in Helsinki 1984, Budapest 1986 and Yugoslavia 1988, form the basis of several of the cases in my thesis. This, and my involvement with the University and with my supervisor, has provided an important source of motivation and encouragement to me in undertaking the research.

CHAPTER 2 - STRUCTURE OF RESEARCH

The starting point

The thesis is an account of the personal journey I made in conducting this research. An outline of the structure of the research is shown at Figure I, together with the time scale, Figure 2.

The starting point for me was my knowledge and interest in job design. I believed that it was possible to design and organize people and work for both job satisfaction and efficiency and from my own and other peoples' research I believed I could prove this. This knowledge and my ideas was reflected in my book on job design.

However, the advent of new technology and computer systems of information and manufacture represented a challenge to this position and I recognised that while I was an authority on job design I really did not know what the implications of new technology for job design were. On the face of it, it appeared that the technical and economic benefits of computers undermined the potential role and contribution of people and that technical imperatives inhibited the opportunities for job satisfaction.

I began, then, very much at the level of individuals and their job and what was the impact of computerization on the nature and content of peoples' work. Knowledge of job design has suggested that characteristics such as variety, autonomy, feedback and social interaction were important to job satisfaction and peoples' sense of involvement. Therefore, I needed to know how far computerization in either the office or on the shop floor, enhanced or detracted from these characteristics.

A further issue at this and subsequent stages was how far the factors involved were similar or different in the office as opposed to manufacturing situations. Thus, while much of my own experience related to manufacturing, I was also keen to explore the position in the office. However, I had concerns as to whether it was realistic to explore both situations and yet I needed to know about the relevance of job design not just in relation to computerized manufacturing but also to systems of information as well.

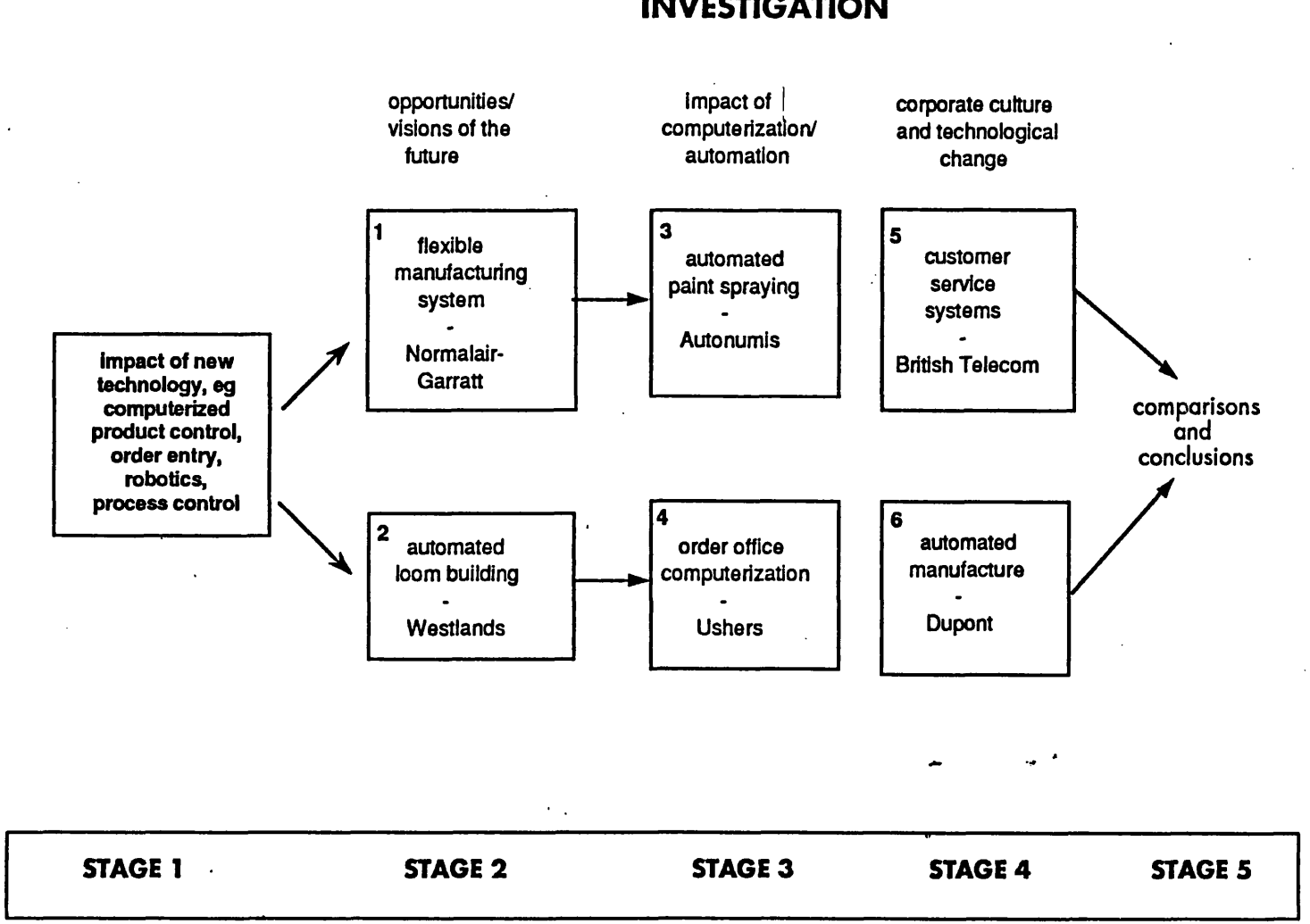


Figure 1 - Structure of the research

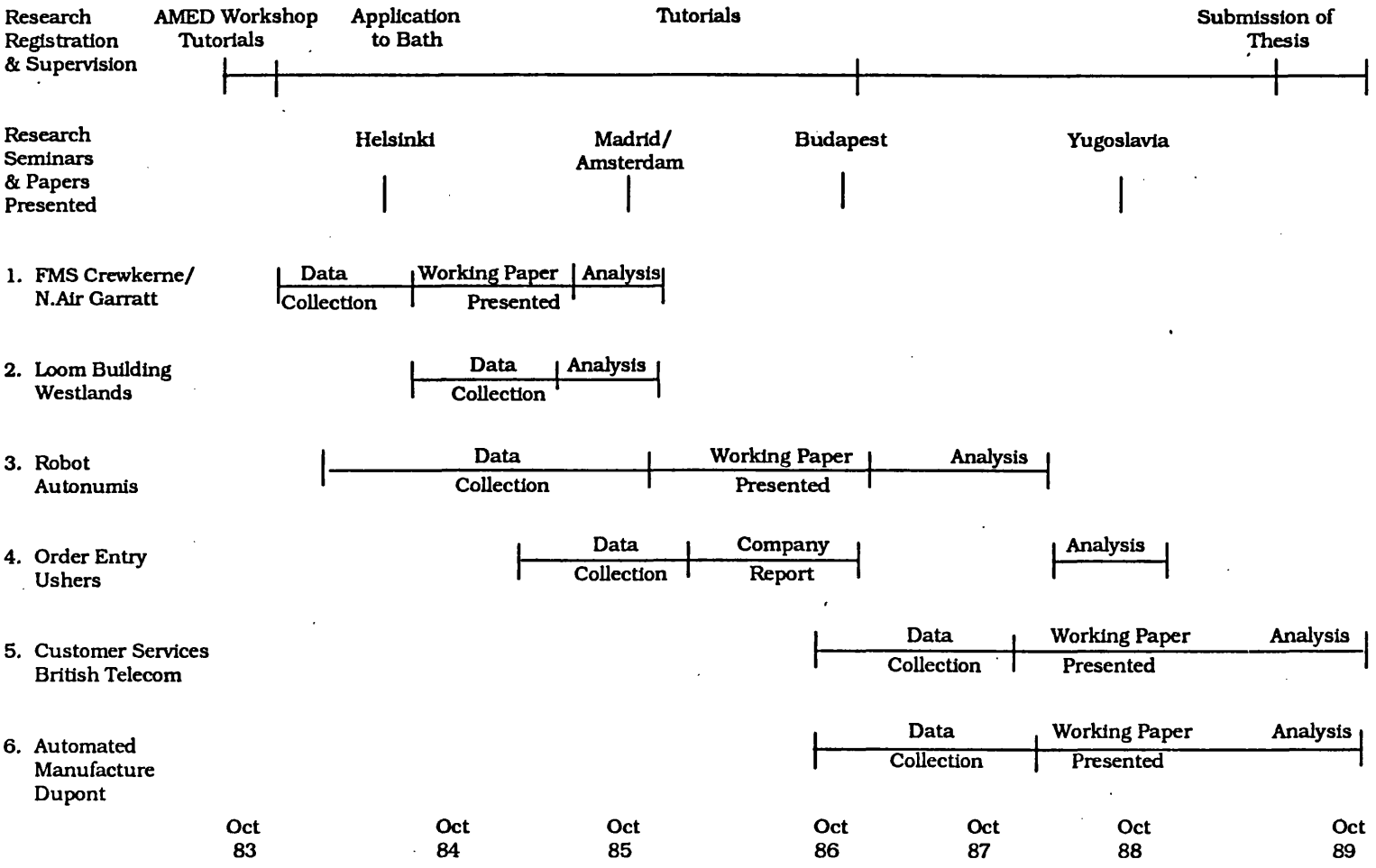


Figure 2 - Timescale of research

Stage 1: Literature survey of the impact of new technology

My approach to the investigation was therefore on a broad front exploring the impact of computerization in a wide range of office and manufacturing situations. Initially this was achieved through a study of the relevant literature and of published cases on the introduction of new technology and this represented the first stage of the research.

Thus, for example, in Stage I, I looked at office applications such as the computerization of production control and sales order processing, the introduction of word processing and computer aided design. In manufacturing I looked at computer numerical control of machinery, robotics, process control and flexible manufacturing systems. In all of these areas I was interested to identify the effects that computerization had on the nature of peoples' work and wherever possible the impact on the characteristics of their jobs. I was also interested to note any effects that the approach adopted to work organization had on these aspects and if this could counteract some of the possible negative effects that arose.

Stage 2: Visions of the future

During 1984, while reviewing published cases on job design and new technology, I started to scan for any cases in the field involving the application of new technology. I wanted to see for myself what was actually happening and if possible to obtain data on the issues concerned at first hand. While I had looked at many job design situations in practice my experience of new technology and computer systems was more limited. It was therefore important for me to see these new applications and learn something of the new technology itself. I was also seeking examples of applications that demonstrated an awareness of the human factors concerned. This initial field work represented the second stage of the research.

An article by Mark (1981) in the New Scientist which described a flexible manufacturing system (FMS), part of the Normalair Garratt Group at Crewkerne, caught my attention because it spoke of '*the factory of the future*' and because reference was also made to the use of team work. I had the opportunity to take a group of students to visit the factory as part of the DMS residential week. The visit proved to be very

illuminating and I was able as a consequence to gain access for further research. This case study proved to be very useful and significant in that it demonstrated the value that alternative forms of work organization such as group working can have in the introduction of new technology. It also revealed useful information about the structure and style of management required in such situations.

From my studies of the literature I developed a questionnaire to serve as a guide for data collection (see Appendix 1). This was based on a broad socio-technical systems model (see Appendix 2) which I developed out of my work at Aston, which identified some of the key variables in the system. By this stage, although I recognised that new technology would have significant impact on the nature and content of the jobs, I realised that potentially there were many other factors and variables involved. Thus, my approach to the investigation at this stage was on a broad front with the intention of exploring a number of related issues such as the organization structure, the role and style of management and the approach adopted to the introduction of the changes, as well as the effect on the nature and characteristics of the jobs concerned.

Detailed discussions were held at the FMS site itself at Crewkerne, in particular with the factory manager, about the operational aspects of the new system and with the workforce about their jobs. Use was made of the Hackman and Oldham Job Diagnostic Survey to tap peoples' reactions to their job characteristics and this was combined with group discussions to verify and explain their responses and to obtain their reactions to the wider issues of their involvement on the site.

The value of this case was in its illustration of the need for and benefit of changes to the social structure of the organization as well as to those involving the technology. While not necessarily as a result of conscious planning the changes to the work organization and to structure and style of management concerned, significantly affected peoples' satisfaction and sense of involvement and the ultimate match between the human and technical systems involved. In this sense it provided me with a *'vision of the future'* and an indication of what might be possible through the conscious application of job design techniques.

In the autumn of 1984, I was invited to visit Westlands Aircraft at Yeovil who were actively employing the application of new technology to various aspects of the design and manufacturing operations. My contacts were particularly with their Research and Technology Division who were responsible for identifying opportunities for computerization and automation and for initiating feasibility studies.

From my discussions there it became apparent that they were concerned for and conscious of the human and organizational aspects and implications of their work and were anxious to develop this. As a consequence I became involved as a consultant and source of advice to them in this field.

Our investigation on the automation of aircraft loom building presented particularly interesting opportunities and challenges. In modern aircraft and helicopters increasingly complex wiring looms are required for the instrumentation and control systems. However, the manufacture of the looms has been a very traditional craft-based activity in a heavily unionised part of the company. The loom building task which I was able to observe was tedious and very laborious and it could take weeks for one person to build a single loom. While the technical opportunities for automation offered the company considerable potential savings in labour and in the time taken to build the loom, the human and industrial relation implications of making such changes were quite formidable.

The company therefore decided to approach the change on a totally participative basis involving the trade unions, and the workforce planning the change. A small group of loom builders were seconded to the R & T division and together with their engineers they designed a mutually acceptable solution. They described what they were doing as 'job design' without actually realising that this was an identifiable process and technique on which a considerable amount of information and knowledge was available.

While union sensitivity inhibited my direct involvement in this particular case, I was able to obtain much of the necessary data on the changes and options considered and on the reactions of the staff concerned. My own role became more of

a facilitator helping those in the company to do job design rather than being involved directly myself.

However, this case study was invaluable as an example of a participative approach to job and system design. It demonstrated very effectively how involvement in the planning and change process can lead to an acceptable match between the technology and the people concerned. However, in addition it yielded some most useful data about the role of technologists as change agents and their part in the work organization development process.

These two cases which, over a period of 12/18 months, I had the opportunity to study in some detail provided me with an insight into what might be possible in terms of the introduction of new technology. On the one hand we had a case which illustrated that group technology might require group forms of work organization to ensure the effective involvement of people and the technology concerned; on the other hand we had an illustration of how one can achieve an acceptable match between peoples' needs and those of the technology through participation in the design process. Thus, the two cases were complementary illustrating, on the one hand, the process of work organization design and the identification of alternatives and options, and on the other hand, the process of change, development and implementation.

Stage 3: Impact of automation and computerization

However, while the case studies in Stage 2 provided a view of what was possible in terms of the effective involvement of people and new technology, they were very much the exception than the rule. Even in these cases where the solutions had been very satisfactory from a human point of view, they had not arisen from the conscious application of job design techniques. Thus, while a large body of knowledge of job design existed, the question still remained why it was not employed when introducing new technology.

Evidence of this and related aspects of the introduction of new technology came from two further studies which represented Stage 3 of the research. These two cases,

one of an automated paint spraying plant and the other of a computerised order entry system provided some evidence of the constraints and problems surrounding the introduction of new technology. In particular, they helped to explain why human factors can be overlooked in the introduction of these new systems and some pointers as to why the available knowledge of job design and socio technical systems is not utilised.

The opportunity to study the first case came in the summer of 1984 as a result of my involvement as co-ordinator of a teaching company scheme with small firms involved in introducing micro-technology. In this case, Autonumis, who manufactured vending machines, was involved in planning the introduction of an automated paint spraying plant employing a robot. I saw this as an invaluable opportunity to both observe and hopefully influence the planning process and the ultimate solution adopted.

However, despite being invited to attend the planning meetings and providing data about the impact of the new system on the job characteristics and satisfaction of the paint sprayers, the concerns and interests of management and the contractors was almost exclusively with task and technical considerations. Issues such as the organization of people on the new plant, their training and involvement, eg in the programming aspects, were dismissed as secondary considerations to the problem of getting the new equipment installed and working.

The problems with the new system and with the people concerned therefore did not appear until after the system had been implemented when the morale and satisfaction of the paint sprayers and their supervision hit an all time low. This, coupled with operational and environmental problems, caused the production director at the time to say '*that this robot is a wasted asset and it's got to go*' a view that was strongly echoed by all those involved in the paint shop.

Although over time many of these problems were overcome and some changes and improvements were evident on the human side, the case did demonstrate quite forcibly how lack of analysis, planning and representation of the human and social

aspects of the change can have serious negative effects on people and on the performance of the system. It also showed that while people may be prepared to accept changes on the technical side of the business, changes to the social structure and the relative roles of management and work people may be harder to accept.

In the summer of 1985, the opportunity to study the other case, the computerization of an order entry system, came from my continued contact with the distribution department of a brewery, Ushers at Trowbridge. I had been involved over a period of time with this company on a major project to increase employee involvement. As part of this project the distribution department had been restructured into smaller semi-autonomous groups/teams in order to provide a better service to the customer. The project, which I was able to evaluate, was very successful in that customer service and efficiency was much improved together with job satisfaction, team work, and industrial relations. So much so that the distribution manager and his staff won the National Distribution Management Award for the year in question.

However, two or three years following this, in 1984, a new distribution manager was appointed at a time when costs and competition were increasing quite dramatically. His rationalization of the distribution function coincided with the introduction of a newly developed sales order processing system based on a computer. Although I was not employed at the time as a consultant, I was able to negotiate access to study the effects of the computer on the staff concerned and how this and changes to the structure might have effected their jobs and sense of involvement.

I was able to obtain some very useful evidence about the reaction of the staff to their jobs and also to the relationships between the functions concerned. While the staff appreciated many of the features of the new system such as the more ready access to customer information, the fact that they were now more isolated both physically and organizationally from the load planners and draymen, and other members of the team was regretted.

While the appointment of a telesales supervisor who saw it as her job to deal with problems and queries, may have helped the girls to concentrate on sales, their sense of autonomy and responsibility declined as a result.

Thus, while the system may have been more efficient in terms of promotion and the sales operation, it raised some questions over the effectiveness of longer term customer services and relations. The relations that the individual members had built up with their customers and with the other members of the delivery team appeared to have been sacrificed to the need of efficiency and sales promotion.

This case, apart from further illustrating the negative consequences of the domination of economic and technical factors in the planning stage, also illustrates the relationship between strategies and structure. In fact both cases in Stage 2 illustrate the possible dangers of basing the introduction of new technology on cost saving and efficiency criteria alone. In today's business environment where customer service, quality and consumer choice may be as important as price, there is a need for this to be reflected in the design of the delivery system of the product or service involved. This may call for an organization structure and design which enables all those people who need to work together to provide the customer the product or service that he/she requires.

Finally, the other aspect that emerges as a strong feature in both cases in Stage 2 is the conflict and tension between autonomy and control. In both cases the effectiveness of the process could have been enhanced if the people doing the job had had more autonomy and discretion to solve problems, and yet in the design of the systems, responsibility and the opportunity to make decisions were diminished. Also, decisions made regarding the structure of the organization concerned were based on traditional models of management and organization, namely, specialization of task and centralization of control. This, combined with the impact of the computer technology, dictated the result in terms of the balance between people and the technical system concerned. It has also ensured that while changes in technology were introduced, no significant change was required to the role, structure and style of management concerned.

However, subsequent analysis of the robot case in particular has helped me to recognise that new forms of management and organization may be required by new technology and the issue is how to ensure that the need for these changes are also recognised.

These cases point to the influence of the culture on the way the technology is introduced and whether or not human factors and techniques such as job design feature in the process. These aspects and the impact of culture on technological change were explored in the next stage of the research.

Stage 4: Corporate culture and technological change

Having identified the importance of culture and its influence over the role of technology and its introduction, I was looking for examples that would illustrate this point. The final phase of the field work has therefore involved two case studies which demonstrate what can be done to create a culture in which the introduction of technological change and matching of people and technology can be successfully achieved. In both cases a high level of awareness and concern for human factors has conditioned the approach to organization and system design and in both cases it would appear that the employees, the company and ultimately the customer have stood to benefit from this. They are in this sense '*illustrative case studies*' in that they demonstrate an informed and enlightened approach to the introduction of technological change and the value placed on human involvement in the business.

My involvement with British Telecom began in the summer of 1985 when I came to learn of what was being done to improve customer services in this industry through my attendance at a conference at the Technological Policy Unit at Aston University. Here I learnt that a new computerized system was being developed to improve customer services in British Telecom and I expressed great interest in what they were doing and in particular in their approach to the change.

Having met the people concerned for the development of the technical system I was introduced to the Project Manager and his team who were responsible for the overall philosophy and approach to the change.

The company have suffered in the past from a very bureaucratic and complicated structure which has been highly unionised and the customer, in many peoples' eyes, was about the last person to be considered. However, from my discussions it became apparent that a very major change was planned not only in terms of computerizing all the manual information and records, but also revising the structure and communications system. This involved a totally new function in the form of a customer services system. A 'front office' with specially appointed and trained staff would deal with the majority of customer queries and requests. This change called not only for the development of new computer based systems of information and communications but for radically different jobs, organization structure, attitudes and skills.

At the time I was very keen to be directly involved in analysing the changes required to the jobs as a result of the introduction of their customer services system. However, telecom had their own job design and organisational development unit in London a nd a very competent occupational psychologist was seconded to work with the district manager and staff concerned.

My role was therefore more in terms of observation of the process which in many senses proved not only more appropriate from the point of view of my research but more revealing overall. My contacts with those involved in the planning process demonstrated that they were very aware and concerned about the scale and scope of the change that was planned and the need for consultation and participation at all levels and stages.

Thus, apart from producing some very valuable information about the changes to the jobs, systems and structure as a result of CSS (Customer Services System), it was their approach to the management of change that was perhaps the more significant aspect. Their approach to the selection and training of the front office staff and to the design and development of their jobs was cautious but effective. Similarly, the extent to which trade unions and employees themselves were involved in analysing and studying the changes appeared to have helped in gaining acceptance of the new system and its introduction.

While it is recognised in British Telecom that these changes are only the start and that there is still a l ong way to go, progress so far and the resources and commitment made to achieving these changes provide some encouragement for the future and an illustration of what can be achieved.

My attention was drawn to the second case by one of my colleages in the Engineering Department of the Polytechnic. He explained that the company, apart from employing advanced technology, also appeared to have a very different style of management and way of treating people. The company, Dupont, are a high technology company that manufactures electronic connectors for the computer industry. Like several in the business, they have very advanced concepts of organization and management and put a very high premium on the value of human involvement. This culture, which they believe is an important and integral part of their competitive strategy, is defined and is widely promoted and publicised.

Along with other companies in the electronic and high technology business they have had the advantage of developing on a 'green field' non-union site and thus many of the constraints that exist in a conventional organization do not apply. Their corporate culture has, however, been developed with and through the involvement of the workforce and despite its relative success they are still actively engaged in its further development in practice. In this context, I myself have been active with the organization for some time as a consultant helping them to evaluate its effectiveness in practice and to improve their concepts of self-management and team work.

Apart from the development of automated systems of manufacture of connectors, the firm in conjunction with the Polytechnic, with whom they have a close working relationship, hav e been developing an automated system of 'quality control' employing the computer.

In these circumstances, rather than being seen as the 'threat or watershed' as so often occurs, computerization and automation are seen as the norm and a natural complement to human involvement. Participation in its introduction and the

development of the new system is not an issue to be discussed because it is part of their philosophy and normal way of working.

My involvement with the company started in the autumn of 1985 as part of the Polytechnic team on the development of their automated quality control system. Since then I had had a role as consultant to them on self management and team work and this has provided me with the opportunity to study their culture and its development in some detail. For example, apart from their emphasis on quality and customer service, as part of their strategy their approach to management contrasts dramatically to conventional systems of management. This and their approach to organization and the self managing teams, each with a responsibility to their own suppliers and customers, reflect fundamentally different assumptions about people and their role in the business. It also indicates a very different set of values and models of management and organization from the traditional approach.

This case has enabled me to summarise some of the key factors that are likely to influence the introduction of new technology and the organization's ability to adapt to change. The factors can be seen as key elements in the corporate culture of the company each one of which is capable of analysis development and change. The significance in a company such as Dupont is that they are conscious of their corporate culture and its impact on people and organizational effectiveness. They are therefore prepared to invest time, money and resources to ensure its continued development.

However, they have had the advantage that their culture has been developed in the context of a green field site. One of the issues therefore within this thesis concerns the importance of culture to achieving continued organizational effectiveness is how far such changes can be brought about with the constraints and traditions of a traditional organization structure?

Stage 5 Comparisons and conclusions

The final stage of the research has involved a review of the cases and findings from my investigations in order to help me to answer the fundamental questions that I posed at the beginning of the thesis.

This process has helped me to draw conclusions about the research and the conditions under which job design can make an effective contribution to the introduction of new technology. It has enabled me to identify some of the key variables that influence its effective introduction and their inter-relationships. These have been developed as a model which was used in the final stages of my research.

CHAPTER 3 - JOB DESIGN AND NEW TECHNOLOGY
A Literature Base

This chapter incorporates the results of an initial literature search in the field of job design and new technology. It also encompasses a discussion of other related issues namely management organization, strategy and culture. These aspects were studied at later stages in the research, but are discussed here to help the reader understand the perspectives I came to adopt.

Job design and work organization

The starting point for my research in this field was the work I did in writing my book on Job Design and Work Organization (Bailey 1983). In this book which was subtitled 'Matching People and Technology for Productivity and Employee Involvement' I looked at the development of job design and work organization and its contribution to achieving the above goals. In the book apart from reviewing issues such as alienation, motivation and job satisfaction I looked at job and work organization design both in theory and in practice. In addition, I examined the impact and implications of new technology and the management of technological change. In the final section I looked at some of the wider issues for the future such as the trends towards decentralization, the demise of the assembly line, the increasing significance of green field sites, the need for and implications of increased education and interest in the quality of working life.

The book enabled me to review the problems associated with the 'scientific management' approach to work organization and its impact not only on job satisfaction but also on factors such as performance, productivity, quality and customer service.

In the book I looked at the work of Woodward (1965) and Blauner (1964) and the comparative effects of mechanisation and automation on workers alienation. I drew attention to the fact that while mechanisation tends to reduce workers' sense of control over their work, automation as in process type industries tends to restore

their sense of control over the process. Thus, the introduction of computer control and automation can potentially do much to restore worker autonomy.

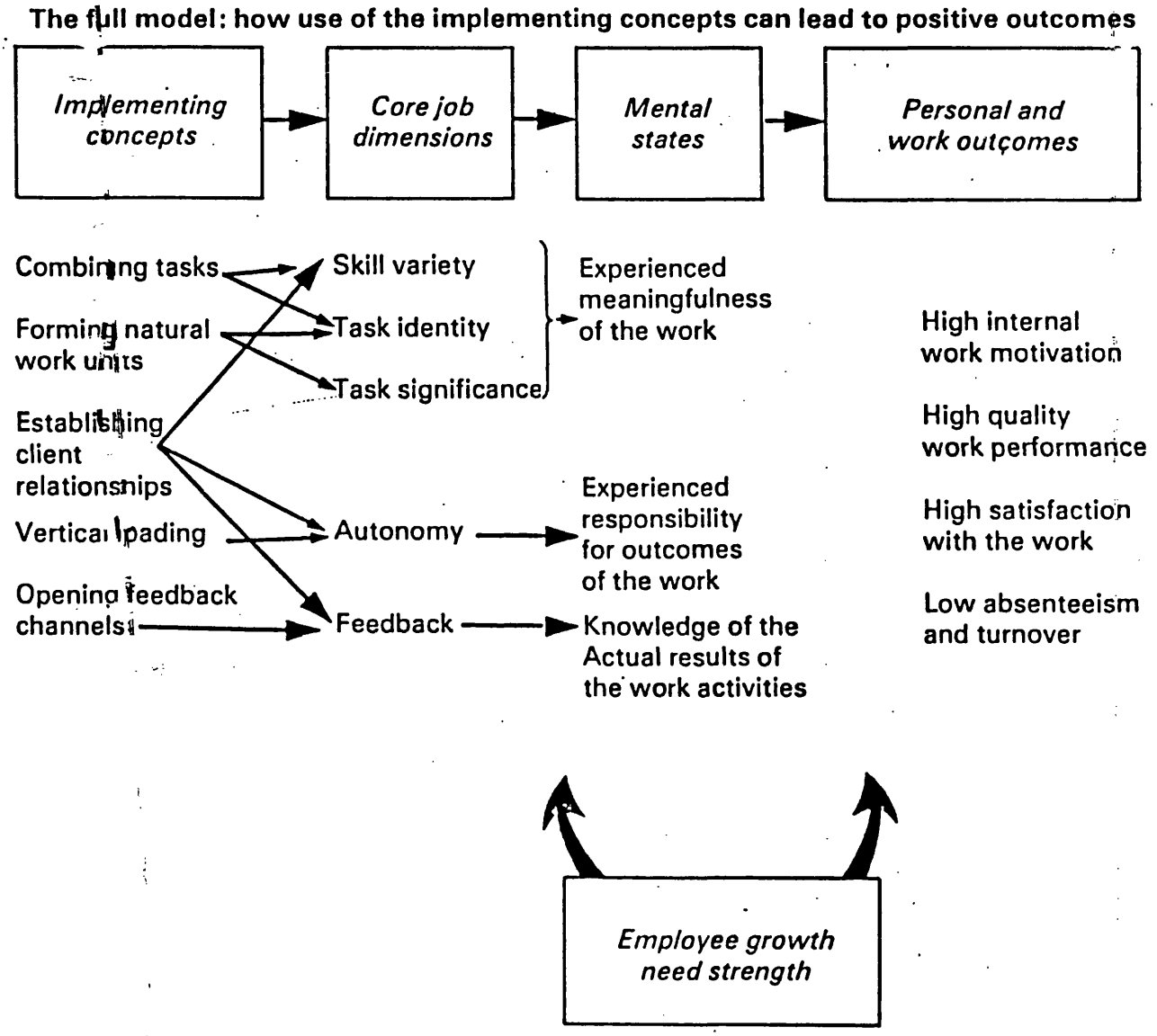
In my review of motivation theory I examined what research implied for job design. I drew distinctions between the *'content and process'* theories of motivational research and concluded with a broad acceptance of Schein (1965) model of complex man. Thus, while we may be able to say that th e possession of a clear and meaningful goal and of discretion and feedback can lead to greater motivation, whether this is so will also depend on other factors such as pay, equity of treatment and employees' need for growth and development.

In terms of job design I was able to demonstrate how through the work of people such as Hackman and Oldham (1975) it had been possible to consolidate the findings from motivational research into the desirable job characteristics that should ideally be built into peoples' work. Those characteristics which can be defined and measured can be used operationally for the diagnosis of work problems and for job design in practice. I felt that the existence and availability of such measures was particularly relevant to the introduction of new technology since they could be used both to analyse and predict its effects on people's jobs, and as part of the design process and for post implementation evaluation. (See Figure 3 for operational model of Job Design)

A further major influence on my research was the work of the Tavistock Institute on Socio-technical systems (Emery 1954). Apart from their contribution to the development of new criteria for job design it was their concept of *'organizational choice'* in the introduction of new technology which I felt was particularly relevant to my research. While these concepts may have been developed in the Durham coal mines in the 1950s (Trist & Bamforth 1951) they seem to have a renewed sense of relevance in the current decade and to the introduction of new technology.

The overall notion proposed that changes to the technical system are likely to have implications for social systems and structures has to my mind an inescapable logic which profoundly influenced my whole approach to the research. Similarly the

Figure 3 Operational Model of Job Design



notion of alternative forms of work organization and the relevance of group working, for example to the application of new technology, also influenced my thinking.

The work of Wild (1975) and Burbidge (1976) highlighted the significance of group working in a manufacturing industry as a means of achieving involvement in work organization issues and of more effective individual job design. In many situations today the group or team becomes the vehicle through which job rotation, job enlargement and job enrichment for the industrial worker can be achieved. Indeed the development of computerization and the increasing use of group technology in manufacture seems to imply the need for group forms of work organization to accompany them. Thus, I felt that new technology may well call for newer approaches to the organisation of people and work.

Finally, Davies (1979) suggests that technology rather than being fixed can be seen as the required combination of skills, equipment, facilities, tools and technical knowledge to achieve the necessary transformation. This demonstrates that choice may be necessary and possible within the technical and organizational aspects of the socio-technical system. The classic illustration of the choices and alternatives available was of course in the Volvo case studies and the contrasts between the Kalmar and Gothenburg plants. This work gives substance to the fact that technology should not be seen as a constraint to the forms of work organization that can be adopted and indeed that technology can be adapted to the form of work organization chosen.

Impact of new technology on job content

At the stage of writing my book the amount of published data on the impact of new technology was quite limited. However, I referred to a number of case studies and applications including numerically controlled machines, computer aided design, robotics, process control, manufacturing and various applications of word processing. In each case I explored the impact of the computer based system on the people concerned and on the nature and content of their jobs in particular. Thus, for example, in machining, while there was a reduction in the requirement for manual skills there was an increase in the demand for programming skills. While the requirement for discretionary skills and decisions relating to speeds and feeds

are reduced, the demand for perceptual and conceptual skills are increased, such as the ability to interpret drawing and programme machines. However, as Hazelhurst et al (1979) points out the impact on the content of the job depends not only on the technology itself but on management philosophy and policies. Thus, for example, the level of inspection required and who should be responsible for the development of programmes vitally effect the responsibility of the machinists' jobs and is independent of the technology concerned. This feature of management philosophy and policy emerges as a major issue in the introduction of these new systems and greatly effects the nature of the ultimate match between people and the technology concerned.

The contrasting impact of the robotic and process control examples demonstrate the overall point that the effects of computer systems on the nature of people's jobs also vary with the type of application concerned. Thus, in the case of robotics the intention and the effect is to replace many boring, repetitive jobs often involving high health and safety hazards, eg spraying and welding. However, in the process control situation the effect is potentially to give more control and feedback to the operators about the process and eliminate their physical involvement in the process altogether. In a case of a large biscuit manufacturer an autonomous group had its own microcomputer and VDU so that they could monitor all the relevant production information such as weight, moisture and levels and recipes, Buchanan and Boddy (1983). But here again some writers point to the fears of some managements of the increased power and control that the new technology has given shop floor workers over the production process, Wilkinson (1983). In these cases the potential benefits of greater responsibility and shop floor autonomy as a result of new technology may not occur because of management assumptions about peoples' attitudes and motivation and their desire to maintain the '*managerial prerogative*'.

One of my students did a study in the production control department of a tobacco company on the possible effects of the introduction of a microcomputer on the job of production control clerk. Here, while little change was anticipated in such factors as variety and autonomy, improvements were expected on such factors as task identity

and feedback. The use of the diagnostic survey, Hackman and Oldham (1980), has proved to be a very useful tool in predicting and analysing the impact of new technology on job content and job characteristics.

In this particular case it demonstrated that while computers may have little or even negative effects on some aspects or characteristics of the job, others may be considerably improved.

The case of computer aided design demonstrated quite forcibly that the effects of new technology on people depends as much on management philosophy and assumptions as it does on the technology itself. Thus, while CAD removes much of the routine and semi-clerical work associated with design draughting and speeds up the detailed work required, whether it releases the staff for more complex and demanding design work depends on management. It may be used as a means of extracting more work from the people concerned and as at Rolls Royce, with the application of work study methods to increase productivity. Thus, as this case shows **new technology** can either be viewed as a way of enhancing the contribution of creative employees or squeezing greater output from the human machine!

Similar issues emerged from studies of the application of word processors to typing or secretarial work. The human impact of word processing varies to some extent on the level of the job concerned. For the typist it can do much to ease her job as regards layout and corrections and can increase her level of output dramatically. For the secretary, whose job often involves much more than typing, there is a danger that it can detract from her satisfaction and the service she provides. Many of these functions such as problem solving, decision making, organizing and arranging meetings depend on face to face contacts and cannot be automated. There is a danger that when word processors are introduced people will become dedicated word processor operators divorcing them from the communications, decisions and human interactions of the office, Buchanan and Boddy (1983). However, I described two case studies where through recognition of these potential problems and through the application of job design and work organization concepts, both productivity and job satisfaction were enhanced, (Bailey 1983).

A further important factor addressed in this initial study was the attitude of trade unions to new technology. In this I drew attention to the increasing tendency particularly amongst white collar unions for new technology agreements. Trades Unions such as APEX have particularly drawn attention to the potential negative consequences of the application of new technology and of the need for job design to be used in the introductory process (APEX) (1985). Indeed the unions could be a powerful force for greater consideration of human factors in the introduction of new technology.

From this initial study of new computer technology I was able to make a number of observations:

- While it removes much of the manual content of both craft, design and clerical tasks, it can create additional demands for perceptive and discretionary skills.

- Its impact can vary from one situation and type of job to another. This can take the form of a **polarising** effect reducing some jobs such as in robotics to simple loading and unloading tasks, while creating new and more responsible jobs associated with the programming and maintenance of the computer system.

- Potentially computers can provide the opportunity for operators and staff to exercise more control over their work and processes by the more ready provision of feedback and control information. However, whether this occurs is dependent on management's attitudes and willingness to delegate control to the working group.

- While the impact of new technology may have little or negative effect on some aspects of job content such as variety and autonomy, other factors such as task identify and feedback may be enhanced. Job design techniques and tools can be used to predict and measure the impact of new technology on job content in the introductory process.

- The use of job design tools and concepts and alternative forms of work organization can do much to assist the effective introduction of new technology and avoid its negative human consequences.

- The extent to which this occurs depends in the main on management assumptions and values. Whether new technology detracts or enhances the quality of peoples' working lives depends not so much on the technology itself, as on management assumptions and philosophy. New technology can either be used as a means of extracting more output from the human machine or of enhancing the creative human contribution.

- Concern and pressure from the trade unions can be an important factor in encouraging management to give more consideration to the human factors when introducing new technology.

Review of Stage I of Research

Literature survey

The first part of my research started very much at the level of the individual and consisted of a review of the literature of job design and of the impact of new technology on the content and organization of people's work. Through my book I had been able to develop my understanding of job design and its application, and this helped me to study new technology and its human implications. The recognition that in designing jobs and effective work systems we need to take not only economic and technical factors into account, but also human and social considerations. This enabled me to identify the objectives that we should be seeking in terms of good job design.

These factors such as Task Identity, Variety, Autonomy, Feedback and Social Interaction can be identified and measured and can provide social objectives in the design process. In addition, I demonstrated that there were alternatives to the traditional approaches to organizing people and work of specialisation and control. These alternative forms of work organization such as job rotation, enlargement, enrichment and group working, could provide the means of achieving the job design objectives sought.

However, although the impact of new technology varied according to the application, I found that its effects were often negative in human and social terms not only from a quantitative point of view, but also on the qualitative nature of the jobs. Not only was the skill element often eliminated or transferred to a tape, but discretion, responsiibility, variety and task identity also suffered. However, it appeared that the impact of technology on job content and hence on motivation and job satisfaction was not so much a function of the technology itself, but on the way it was introduced. Dependent on the assumptions of management and those involved in planning the changes, technology could either enhance or detract from peoples' contribution. The extent that this occurs appeared to me to depend on management assumptions about the relative roles of people and technology.

However, job design concepts and tools did appear to me to be relevant and could be used in the introduction of new technology. If they are combined with alternative forms of work organization, it could overcome some of the negative effects that can otherwise occur. Thus, in the initial phase of my research, I was interested to establish how far this could be achieved in practice.

Organization, management and technological change

However, while the initial starting point and literature reviews for my research was at the level of the impact of new technology on peoples' jobs and the potential contribution at job design can make to its effective introduction, my own beliefs and experience suggested that the issues concerned were much wider than this.

My earlier work for my book contained much about the wider impact of job and work organization changes on such aspects as the structure and style of the organization, reward and control systems and the role of management and supervision. These beliefs were reinforced by further study at the stage of formulating my research proposals. My involvement at Aston as part of the Association of Teachers of Management research training scheme gave me an initial opportunity to think about both the field of the research and the possible methodologies involved.

My experience at Aston and involvement with Dr Diana Pheysey, my supervisor at this time, helped me to recognize the number of structural variables involved in this area and their interdependence. However, valuable though this perspective was in identifying the 'design' options and choices available, my involvement at Bath has helped me develop my understanding of the processes involved and their influence on the relative weights and importance attached to the variables concerned. In the end I believe that successful management of technological change comes from a recognition of both of these aspects and thus it is a process of total systems design and development.

In looking at some of the wider issues, writers such as Schumacher (1973) and Galbraith (1971) had drawn my attention to the concept that '*small is beautiful*' and that if we can organize big business in this way it can help to overcome some of the human problems that create a 'drag' on organizational effectiveness and human growth.

Whereas, until recent times, mainframe computers had reinforced the trend towards centralization, the availability of microcomputers encourages decentralization of control and decision making through the formation of smaller more autonomous units.

This, together with the recognition that such forms of organization may be more appropriate in the changing environment of business, is seen as an important ingredient of a company's 'strategic choice', Child (1972). In this respect Trist (1981) draws attention to the opportunities that are created by new technology and green field sites for more fundamental and stepped changes in attitudes and organization.

However, whether these opportunities are taken is very much in the hands of management. Williamson (1983) provides evidence of managements' fear of loss of control as a result of the introduction of new technology, Buchanan and Boddy (1982) in their studies of organization and the computer age show the influences of management attitudes on the way in which new technology is introduced and the forms of work organization adopted. This lends support to the view that the negative human consequences of new technology, particularly in terms of reducing job satisfaction, are not so much as a result of the technology itself, but of management attitudes towards technology and towards people and their involvement.

The latter's studies of technological change in biscuit making and an engineering consultancy firm, explain the effect that different approaches to work organization has on either distancing people from the technology or enabling the technology to complement the people. In this sense, management have choice in how to approach the introduction of the technology.

In an article entitled 'What's new in job Design' Wall (1984) suggests that changes in technology not only imply changes in job content and job design, but also in terms of organization and management. There were big implications for the job and need for supervision and changes in the role of management. The emphasis, it was suggested, is towards more self-management and decision making by the individual and/or work group and this tends towards a flatter, more decentralised structure.

This greater autonomy raises its own problems and demands. It is not a question of abdication by management, but of delegation. People need a replacement for the direction and control they were used they were used to receiving in the form of clearer objectives and feedback so that they can manage themselves. There can be

problems of discipline and control when some individuals take advantage of the more organic situation, and when colleagues do not want to 'shop their mates'. There is therefore a need for clearer guidance and a framework of operation in terms of standards for such things as quality, housekeeping, safety etc. Thus, new technology may call for different forms of organization and management this can add up to the need for a change in the whole style and philosophy of the organization from the traditional situation of specialization, centralization, direction and control.

Organizations exemplifying some of these characteristics were described by Trist (1981) in a paper on the evolution of socio-technical systems. This paper demonstrates the relevance of socio-technical systems thinking and design concepts to the introduction of new technology. Having described the birth of socio-technical systems design processes (Hill 1971), Trist illustrates its more recent application in the development of new plants mostly in the USA. Where social aspects of the plants operation were considered much earlier, the joint optimization of socio-technical design can be better achieved.

These plants with well developed primary work systems had fewer levels, functions and members of management personnel than conventional plants. The number in the workforce were also lower and payment was based on knowledge rather than on the work that people were currently doing. Foremen were non-existent or became facilitators, trainers or forward planners. Information was shared for problem solving purposes rather than being for management control. These plants were learning systems and involved the principle of minimum initial specification to allow the progressive involvement of those concerned at all levels.

This led to a new organizational paradigm (see Figure 4) which, with its flexibility and efficiency in terms of resource utilization, is more appropriate to the resulting turbulent environment.

Figure 4 - Organizational paradigms (Trist 1981)

Old Paradigm	New Paradigm
The technological imperative	Joint optimization
Man as an extension of the machine	Man as complementary to the machine
Man as an expendable spare part	Man as a resource to be developed
Maximum task breakdown, simple narrow skills	Optimum task grouping, multiple broad skills
External controls (supervisors, specialist staffs, procedures)	Internal controls (self-regulating subsystems)
Tall organization chart, autocratic style	Flat organization chart, participative style
Competition, gamesmanship	Collaboration, collegiality
Organization's purposes only	Members' and society's purposes only
Alienation	Commitment
Low risk-taking	Innovation

Management of change

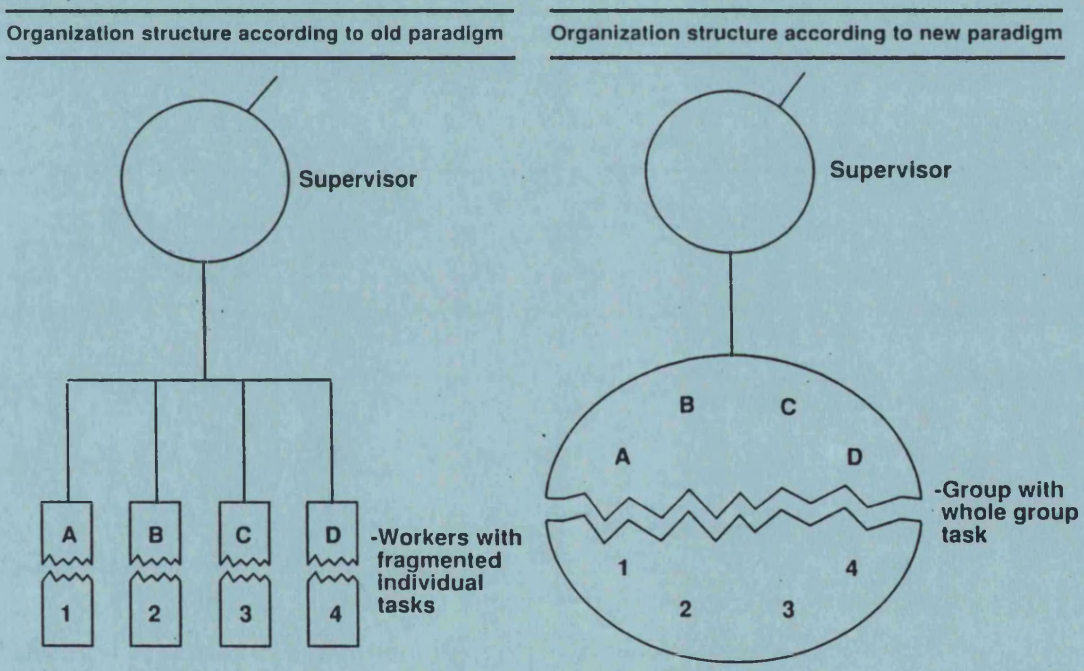
These ideas are reinforced in a recent article by Hans Van Benuin (1988) entitled "New Technology and Organizational Choice". He suggests that the scope and scale of technological change is such as to call for a new paradigm of organization. In designing adaptive systems he argues that there are basically only two choices in the way that an organization designs redundancy into its system. Unless an organization does have redundancy or over-capacity it cannot have the flexibility to adapt to the changes in the environment required.

The two choices of redundancy of parts, or redundancy of functions are, he suggests, based on two quite different value systems. The first option is for people to have narrowly based individual tasks like replaceable parts of the machine. The basic building block in the individual and parts have to be added to the system for the purposes of control and backed up or replaced when they fail. This results in the

charactristically mechanistic bureaucratic and hierarchical systems of much of industry today. This contrasts, however, with the second option which is based on redundancy of functions recognising the multiple capacities of people and their ability to cope with complex roles. Here, rather than adding additional parts, additional functions are added to the individual. This develops the individual's ability to handle a wide range of roles and their capacity for self control. The building block in this instance is not the individual, but the self managing group.

These alternative values represent a different concept of organization as is illustrated in Figure 5 and amounts to what the author describes as a new paradigm of organization.

Figure 5 New organizational paradigm



Characteristics of the old paradigm	Characteristics of the new paradigm
• redundancy of parts	• redundancy of functions
• emphasis on external coordination and control	• emphasis on internal coordination and control
• fragmented socio-technical system	• joint optimization of socio-technical system
• technological imperative — man as extension of machine, a commodity	• man is complementary to machine and a resource to be developed
• organization design based on total specification	• organization design based on minimum critical specification
• maximum task breakdown, narrow skills	• optimum task grouping, multiple broad skills
• building block is one person - one task	• building block is self-managing group
• alienation	• involvement and commitment

However, it is recognised that while such new concepts of organization may well be required, they are far from easy to introduce. The transformation from the old to the new requires nothing less than the working out of a new organizational philosophy!

This, Trist argues is more than simply methods and techniques but involves questions of basic values and assumptions. Whereas the old philosophy was based on technology and bureaucracy, the new philosophy is based on socio-ecological and participative principles. He emphasizes the need for change to be initiated at the strategic level in the organization and sees a value in drawing together of the work analysis and organizational development traditions.

In this context Birchall and Carnall (1974) discuss the need for a strategy in planning and designing technological change and Cherns (1973) discusses the role of action research in facilitating the process. However, in terms of change, Davis (1979) draws attention to the role of the systems analyst and production engineer as a change agent and the importance of involving behavioural perspectives at the earliest stage of this change process. Mumford (1976) draws attention to the value of user involvement in the design process in what she describes as a participative approach to systems design. Clark (1972) when discussing the role of organizational development in making change, draws attention to the need for interaction on all the key organizational variables, namely, economic, technical and social. Organizational development, he argues, has been criticised in the past for seeking to achieve change by intervening on the social factors above.

Thus, we can see that management of technological change is not just about changes in the technology or the social system, but in all of the relevant and inter-related variables. It is not just about changes in operational efficiency, but also in the organization's strategic response to its environment. Finally, it is not about the arbitrary imposition of new systems, but through involvement and participation is a process of developing a new solution involving changes to technology, people and structure, to meet the changing task. This, as Trist suggests, is nothing short of developing a new philosophy of management and organization and a radical change in the organization's culture.

Strategy and technology

While much of the impetus for change in terms of job design and technology arise from internal requirements for increased motivation and efficiency and are related to issues of effective operations management, as my research progressed the link between these developments and the strategy of the firm become increasingly evident. Through my appreciation of open systems thinking and my involvement with business policy teaching, I had been interested in the question of strategy and strategic management for some time. From my earlier work in the field of Organization Development, Bailey (1976), I was aware of the link between strategy and structure and of people like Chandler (1962) and his work on the stages of corporate development.

However, I was always critical of much of the work in the field of Business Policy and of people such as Ansoff (1968) for their limited assessment of human and social aspects of these changes and their preoccupation with economical and financial factors. These views have been reinforced in more recent times because of the changes that I have noted in the environment in which businesses and organizations now have to operate.

It is my contention that in today's more complex and turbulent environment the criteria for survival and organizational effectiveness are changing. While it is clearly important for an organization to make a profit in order to survive, this is only as a consequence of doing the other things that are expected of it. In this respect I am attracted to the stakeholder concept of organizational effectiveness in which the survival of an organization depends on its continuing ability to satisfy the expectations of all its stakeholders, not just the shareholders Johnson and Scholes (1984). Thus the customer's concern for quality, choice and service, the employee's concern for involvement and personal development, and the communitiy's concern for social and environmental responsibility, needs to be reflected in the organization's strategy and plans.

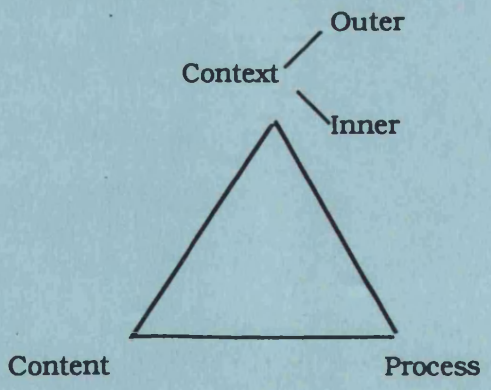
My ideas on these issues are reinforced by current thinking and research in the field of the strategic management of change, Pettigrew (1987). In reviewing the changes affecting the field of Business Policy and Strategic Management, Pettigrew draws

attention to the need for management to have the confidence and capability to sense, articulate and implement major changes in business strategy, structure, culture and people, in order to ensure business success. There is, he suggests, some scepticism towards the more formal strategic planning methods and an increased sensitivity towards the more informal processes of leadership, vision building, communications, team and commitment building as a means of managing strategic change. Strategic change, he argues, involves change in the culture and the structure, as well as product market and geographical positioning.

The question about strategy is whether it is seen as endogenous or exogenous process and whether one should start with the firm or the environment it is operating in. Current thinking would seem to suggest that one is dealing not only with questions relating to "content and choice" and the analytical processes involved, but also with 'process' and the management of change and the context in which it occurs. Thus strategic change is about both the 'why' and the 'how'.

These ideas are usefully summarised by Pettigrew in an analytical model (see Figure 6) relating content and process to context in the field of strategic change.

Figure 6 Analytical model of strategic change



In this figure the outer context refers to the economic, business, social and political formations in which the firms operate, while the inner refers to structure, culture and political context. While content refers to the decision and choices about strategy, process r efers to the actions, reactions and interactions of the interested parties as they move the firm from its present to its future state.

In these circumstances, strategy and its development needs to be seen more as an integral part of the job of management, and the organization itself needs to be strategic in order to respond.

The introduction of new technology in the form of automated manufacturing systems and of computer based information systems can greatly enhance this process, but only if management appreciate the opportunities and links between the two. The development of these systems can release management from many of the day-to-day operating problems to concentrate more on the strategic management of change which is arguably what their job should really be about. Often technology is introduced for purely operational reasons, to minimise costs and the human contribution. In today's circumstances, to achieve the effective involvement of both people and technology we need to provide the service and quality the customer requires.

However, changes in social structure and in the values reflected in it, may be more difficult to accomplish than those of technology. As long ago as 1965, Emery and Trist (1965) suggested that with the way that the environment was developing, with changes not only in terms of computerisation, but of the 'ground' itself, the only way of exerting control was through the development of commonly held values. However, the development of new values was a social process which could take as much as a generation to develop which, they suggested, proved a challenge to social scientist if the rapid change needed was to be accomplished.

Organization culture

The significance of organizational culture has become increasingly apparent as my research has progressed. I have become aware of the current interest in this subject and its relevance to the issues of organizational change. I first became aware of the impact of Peters & Waterman's book entitled 'In Search of Excellence' (1982), when I carried out a study of management philosophies and personnel policies in the USA, Bailey (1984).

This work emphasized the importance of identifying and promoting the values which people stand for in running the business, which serves to provide a focus for management, employees and customers alike. Such concepts as closeness to the customer, productivity through people, and management by walking around, were notions with which practising people did identify. While there has been criticism of its universitality, their work and its successor in the UK (Clutterbuck and Goldsmith, 1984), did bring the notion of management philosophy and organizational culture to the attention of practising managers.

More recently, organizational culture has been the subject of more rigorous academic study. The work of Marshall and McLean (1985), while identifying the complexity of the concept, has provided useful frameworks and methods of analysing and identifying the existing culture. Their work and others (Hennestad, 1988), has highlighted the double bind which constrains attempts to bring about change in culture. While management may promote concepts such as 'putting the customer first' and 'people orientated management' observed behaviour and long standing practices often illustrated by people stories of how the organization works send out a different message.

Bate (1988), in his paper on cultural change in British Rail, has stressed the problems of bringing about change in large bureaucratic organizations. However, he argues that an organization's ability to innovate is a function of its culture, political processes and the competences, personal and interpersonal skills of those involved. $I = f(C,P,S)$. Thus, in achieving cultural change, he would argue, as others have, that one needs to help people identify and conceptualise their existing

culture. With an understanding of the political processes involved in the organization, one can set in motion processes which attempt to reform the culture. This clearly calls for different skills than normally found in a bureaucracy in terms of social and interpersonal competencies.

Mumford (1981), in her work at the Manchester Business School, has concentrated on the political processes involved in the introduction of technological change. A primary indication in her research was of the divergence in values to expectations of the clerks and those of the system designers and middle managers. The clerks, for example, tended to want more discretion, while the expectation of the managers and the system designers was for greater control over the process.

In the four cases she studied, integration was achieved either because the system analysts undetrstood the culture and values of the organization (eg in the Tax Office) or as a member of informal interaction betwen the systems analysts and the clerks (Chemical). In the other two cases (Asbestos and International Bank) integration was achieved because the system designers were aware of the human needs as a result of the training provided by the Manchester Business School. In these cases the solution was one of self determination where the clerks designed their own form of work organization. This, it was felt, resulted in three benefits:

i. It enabled the clerks to determine the form of work organization that fitted their job satisfaction and efficiency needs.

ii. It provided them with a learning opportunity and a chance to understand the functions of the department.

iii. They were committed to the reorganization and the new system because they played a major role in creating it.

In the latter two cases the system designers, managers and clerks shared important values regarding participation and the organization of work. In these circumstances the role of the system designer moves to that of a teacher, adviser or consultant rather than being the sole designer.

As a result of her research, Mumford believes that the change process needs to be adaptive and co-operative to cater for changing needs and interests. Planning in these circumstances is therefore creating a structure in which this interaction can take place rather than planning every step. It also demonstrates the importance of values in preconditioning peoples' approach to change. What is needed is a strategy for bringing together the interests of all groups and helping them to identify some shared values about the sort of future they wish to obtain.

Of particular interest from her studies was the fact that two government departments had declined to be included in the book. In these cases the managers' and system analysts' values conformed to theory X, and they did not include job satisfaction as an objective in the new system, or adopted a participative approach to the change. In these cases therefore one assumes that the predominant values and lack of interaction had precluded a satisfactory solution and fit between human and technological needs.

The results of her research has now been incorporated into a methodology for the introduction of technical change (Mumford 1983) entitled 'The ETHICS Method'. This is based on three essential objectives and value pointers:

i. The importance of allowing the future views at all levels to play a major part in the design of the system.

ii. To enable these groups to set objectives not only in terms of technology and efficiency, but also job satisfaction.

iii. To ensure that the new technical system is surrounded by a compatible organizational system.

The significance of organizational culture for the introduction of new technology was endorsed by the 1988 EIASM conference in Yugoslavia, which was entitled, 'Technological Change and the Managerial Culture in the 1990's'. My paper, which was based on Dupont and entitled 'Organizational conditions for the

introduction of new technology', Bailey (1988) was selected as the first of two keynote papers for the conference and stressed the importance of culture for successful innovation and technological change. While the conference acknowledged the difficulty of defining a culture, it recognised that culture and technology are interdependent when it comes to introducing technological change.

Culture and technological change

While I was aware of the importance of culture when I began my field work it did not feature in my analysis of the first few cases. However, as the research progressed, its significance became more apparent and indeed it became a focus towards the end of my field studies.

At the beginning of my research my understanding of culture was therefore much influenced by the ideas of Peters and Waterman and my own studies of management philosophies and personal practices in the USA. This concept emphasised the importance of beliefs in influencing attitudes and behaviour in organization towards such values as customer service and quality. This concept of culture has been described as a 'mentalistic' notion by Potter (1981) and others who see culture as the mental programming of a group, tribe or nation towards certain goals, values or beliefs. However, while this approach tends to emphasise the similarities in peoples' view of life, my own experience of organizations and certainly from my more recent research, tended to emphasise the differences in peoples' life view. Certainly the evidence from the cases in Stage III at Autonumis and the Brewery highlighted significant differences in attitudes, norms and expectations and values.

This suggested that culture has also to do with 'the way things are' and 'the way things are done around here'. Thus, such factors as the structure of the organization and whether it is formal, hierarchical or bureaucratic, the type of management and the degree to which authority is stressed, the approach to communication and the reliance on verbal, as opposed to written communications, all help to create a climate and a prevalent culture which profoundly effects peoples' attitudes and behaviour. Of course such factors reflect the assumptions, beliefs, and values of those people in

the organization in positions of power, namely management whose views may not necessarily coincide with others in the organization.

This latter view of culture is more consistent with an anthropological approach which emphasises the differences in the values, norms and beliefs of the different participants in the organization which has considerable significance when it comes to bringing about change.

It is here that the more recent work of people such as Marshall and McLean, Bates and Potter is significant. Their work drew my attention to the contradictions that can occur between the declared values and beliefs of management and those that are perceived by others from their actions. It also drew my attention to the significance of the differences between the values and beliefs held by the different groups in the process and to the political and behavioural skills required by consultants and managers in seeking to bring about change. As Potter (1989) suggests, there is a need to recognise what has been described as the etic or emic approach. A succesful change agent needs to adopt the emic approach whereby they recognise the values and beliefs of the people involved with the change rather than seeing things from their own set of values and beliefs, ie the etic appraoch.

Finally, Mumford in her research on values, technology and work has drawn my attention to the importance of identifying the different values held by the participants in the process of technological change and of developing a change strategy that allows these to be shared. The ideal being the development of a concensus about what people are trying to achieve and what sort of life view people can agree upon.

PART 2

VISIONS OF THE FUTURE

CHAPTER 4 - A FLEXIBLE MANUFACTURING SYSTEM
Matching people and technology in Normalair-Garrett

The first case study: origins and involvement

The next step in my research was provided by an opportunity to visit a factory at Crewkerne, part of the Normal-Air Garratt group, who had recently introduced a Flexible Manufacturing System. From my initial impressions, it appeared that a small group of employees, with a minimum of management interference, were able to run a factory producing a complex product, utilizing advanced computer controlled equipment, with both high levels of satisfaction and interest, and of output and productivity.

Following negotiations with the Manufacturing Director, I was able to gain further access to study the situation in more detail. While I was interested in the performance of the system, I particularly wanted to explore the approach adopted to work organization and job design, but also to the management of the system. How had they been able to introduce such radical changes and how genuine was the apparent commitment and involvement of the work force? Although I did not obtain the information at the time, I formed the opinion that this was an initiative by the Manufacturing Director.

In addition to this, I wanted to obtain information regarding the form of work organization used and the style, management and organization structure. Finally, I wanted to explore aspects relating to the introduction of the change.

Data collection:

To help me plan my approach to collecting data on these issues I prepared a questionnaire (see Appendix 1), which highlighted a number of the key aspects involved in introducing new technology. This served as a guide to planning my interviews and for subsequent analysis.

In order to explore these issues, I arranged interviews with the Manufacturing Director who had been instrumental in introducing these changes, the Factory

Manager who was responsible for the Crewkerne plant, with the Trade Union Convenor who had been involved in the negotiations for the plant and with the 11 staff who were working in the new factory. I decided to utilize more objective measures to assess the change in job content and satisfaction by employing the job diagnostic survey developed by Hackman and Oldham (1980). This, when used together with follow-up small group discussions, provided some valuable comparative data on peoples' opinions about their jobs before and after the introduction of the new system.

The results of my investigations were presented in a paper to an international conference in Helsinki in 1984. The conference was on 'Organization and New Technology' and my paper entitled 'Matching People and Technology' forms the basis of the case study which follows. It was for me in many senses an eye opener and a vision of what the factory of the future could be. It seemed so revolutionary to find such a small, quiet, clean factory working so unobtrusively in a small industrial estate in a country market town and yet achieving remarkable levels of output, productivity, lead-times and delivery dates. Yet all this was being achieved with a minimal sized workforce who, nevertheless, had a very high level of involvement and satisfaction with their working conditions.

Small batch production

One of the biggest problems facing companies in the engineering industry is how to achieve efficiency and high productivity in small batch operations. In mass production, considerable savings are possible through mechanizationbecause of the long runs of standardized products. However, 75% of the engineering industry is engaged in manufacture of batch quantities of less than 50 components and until computerization, it has not been possible to utilize the advantage in these circumstances.

A further problem apar t from the relatively high costs of small batch production, is that of delivery dates where, because of the time it takes to set up a machine, the only economical way is to produce a complete batch of each part in turn. This means that the final product can only be assembled when all the parts have been

machined which can take several months and it only takes a problem of scrap on one batch of a particular component to hold the whole job up.

A further factor in this approach to small batch production is the very high costs of inventory and work in progress that is built up especially when a wider variety of products are being handled in the system at the same time. This, added to the complexities and costs of production control in these circumstances, leads to a very inefficient and costly production system.

An alternative approach to production organization

In order to counteract these problems, Normalair Garrett Ltd, a large, essentially mechanical engineering company involved in high technology products for defence and commercial applications, had recently introduced a flexible manufacturing system in one of its divisions.

Taking the opportunity presented by a large new defence contract, it was decided to create a manufacturing cell employing the latest in computer aided manufacturing techniques. The aim was to reduce work in progress, to eliminate non-production time and to achieve shorter lead times and delivery dates. This would be achieved by manufacturing components based on families rather than batches and using computers for loading and controlling the machining process and for scheduling and production control.

In addition, it was recognized that to achieve full benefit from the new production system a different style of working would be required from the workforce than in a conventional machine shop. Thus, from the outset it was made clear that employees working with the new system would have to be flexible and prepared to work as a team, going where the work demanded rather than remaining on one particular machine.

The technical system

The new system took between 12/18 months to develop around machines which were readily available commercially and were already in use in the main factory. A

small team of production and software engineers aided by staff and research students from Bath University developed the new system based on two very large KTM machining centres. These machines, which were capable of drilling and milling a wide range of components, are linked directly to the factory's main computer which supplies instructions about how to mill and drill the parts and what tools are required for the operations. The machine could choose from 40 tools stored in a carousel and a mechanical arm picks up the right tool and inserts it into the machine chuck. A further 80 tools were stored in an ancillary rack and a mechanical arm transfers the required tools to the carousel, from which it is transferred to the chuck.

A further development is the automation of the loading of the machines. A mobile trolley incorporating a robot, specially designed by the firm with the aid of Teaching Company Associates from the University of Bath , automatically selects and loads the required pallet on to the machine which then holds the part for machining. Apart from removing the heavy physical work involved and the element of risk to safety, it also saves time by allowing the operator to continue working on other parts.

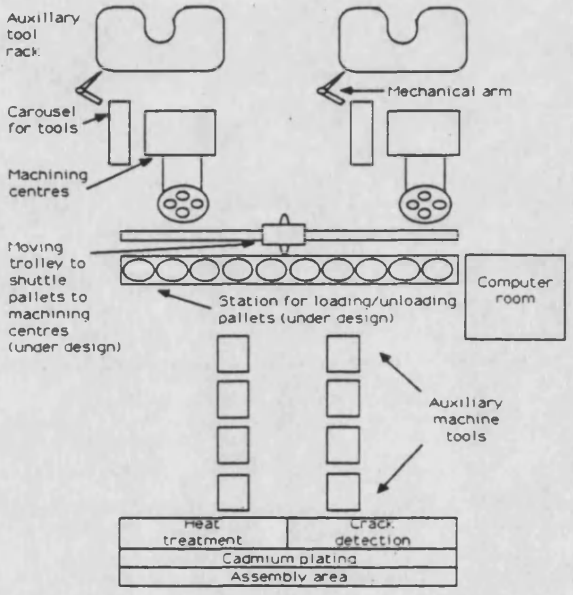
The essential feature therefore in the new machinery process is that the machining centres which are, in effect, versatile machines equally capable of milling, drilling, turning or grinding as opposed to conventional dedicated machinery, eg lathes or milling machines. These machines, coupled to computer control, were able to reload and programme themselves to machine all the parts required for a component in sequence, rather than in batches. This enables the system to produce all the parts required to assemble the first complete unit rather than having to wiat for all the batches to be complete.

The factory at Crewkerne was designed as a versatile system and can manufacture a range of products from the engine for a microlight aircraft, to the current complex mechanism used in the aircraft industry. This mechanism involves some 100 different piece parts, of which only a relatively small proportion are completed on the machining centres. However, these are the most complicated parts to machine and

represent the majority of the total costs. The remaining parts are either bought in and machined on the conventional and numerically controlled machines that make up the rest of the machining capacity of the cell.

Finally, as can be seen from Figure 7, the cell also includes its own Heat Treatment, Crack Detection, Plating Assembly and Test area and is therefore a totally self contained manufacturing unit.

Figure 7 Layout of Flexible Manufacturing System



Working conditions

While being advanced technically the new system also provided very different working conditions from a human point of view to a conventional factory. It was a small factory unit, in a separate building on a trading estate in a small country market town. The conditions were, by contrast to the main factory, very clean, light and quieter and provided a much more pleasant and intimate environment to work in. I was very struck by this example of what the factory of the future could look and feel like for those working there.

Job design and work organization

Apart from the new technology what is of particular interest is the approach adopted to work organization at Crewkerne and how this has affected the design and content of individual jobs. In order to avoid waiting as all machines would not be working all the time, staff who applied to work at Crewkerne were advised that they would have to be prepared to work on a flexible basis and as a team. Thus, it would be up to them to go where the work demanded, whether this was on the machining centres, conventional machines, plating or finishing operations, including assembly of the final component. This was made very clear by both the Manufacturing Director, the Site Manager and the Trade Union Convenor.

To examine what effect the form of work organization adopted had on peoples' sense of satisfaction and involvement, I used the job diagnostic survey developed by Hackman and Oldham (1980). This involved issuing a questionnaire (see Appendix 3) to the staff involved and holding follow-up discussions in small groups to discuss the results and their reasons for their responses. While there were 12 staff including the manager, of the 11 questionnaires issued, nine were returned, the remaining two were unaccounted for, probably because of the shift system.

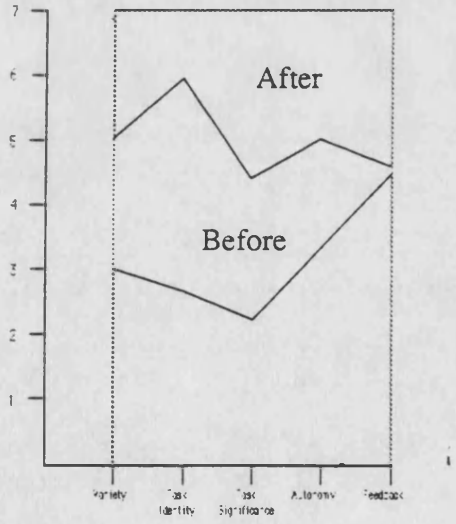
The questionnaire taps people's reactions to their jobs and to such characteristics as variety, autonomy, task identity and feedback in particular. These factors which are based on extensive research into motivation and job design are considered to be key factors relating to job satisfaction.

The approach adopted to work organization meant that in contrast to a conventional machine shop organization where people could be stuck on one batch of components on one machine, at Crewkerne people experience a very large degree of variety in their work. Another key difference is in their sense of identity with the task. In a conventional shop people said that they did not really know what the component was that they were machining, what it was for or where it went when they had finished it. At Crewkerne however, with it being a small unit, organized on the basis of group technology, it was possible not only to see the finished product but also be involved in most of the stages of its manufacture, including quite frequently assisting

on its final assembly. This appears to provide people with a high level of task identity and was frequently quoted as being a major source of job satisfaction. However, while many people felt that the computer had detracted from their job in terms of the skill and discretion that they could employ in the machining process, this had, to a considerable extent, been compensated by the discretion that they could exercise regarding the organization of the work. As one person said "the first thing I do when I come on the shift is to see where the work is" and with the style of management adopted, the work group and individuals are given a high degree of responsibility to decide on which job or machines to work.

While there has been no significant change in the degree of feedback they get from the job itself, their feelings are that the significance of their work has been enhanced by the new arrangements. A summary of the reactions of the employees in the unit, to their jobs at Crewkerne is shown in Figure 8, which analyses the extent to which desirable motivational job characteristics are present in that situation. While further comparative research would be necessary, there does appear to be some evidence that the choices made regarding the form of work organization used, have been a significant factor in influencing employees' reaction to their new job and to the technical system adopted.

Figure 8 Reactions to Job Characteristics



n = 9 (For source data see Appendix 9, Table 1)

Organization structure and management style

There are also significant differences in terms of the structure of the organization and the style of management employed which appear to affect the motivation and sense of involvement of the work force. Because the computer is able to tackle a number of the administrative jobs associated with the production process, the factory runs with very slim management and administrative overheads. Scheduling of work and the progress functions are performed by the computer so that the factory manager is able to tell at any time exactly who is working on what and what stage of progress the job has reached. This removes the necessity for administrative and clerical staff to carry out these functions. Similarly, since the direct machining is computer controlled and the work force take on a lot of the responsibility for allocating people to the work, there is no necessity for intermediate supervision at chargehand or foreman level. Not only does this mean reductions in overheads, it also creates the opportunity for greater involvement by the work force in what have traditionally been management prerogatives. In particular, despite automation and computerization, problems do occur in the production process and the manager concerned invites a high degree of involvement from the work force in tackling problems on the shop floor and in reviewing progress and performance.

The size of the unit, with a total staff of only 12, is felt by most poeple to be a very significant factor in creating the sense of involvement and team working that is evident in the factory. While people miss to some extent the contact with a wider group of people, they argue that in a smaller unit you cannot afford to get at cross purposes with the other people and that they have got to make it work.

It was quoted that decentralization and the creation of a smaller unit was one of the advantages arising from the computer and new technology. It was felt the new system, provides autonomy not only at shop floor level but also to an increasing degree for local management. While the factory manager's job might involve a wider range of activities and functions than would normally be the case, there was also some scope for flexibility and choice in the way that the operation was managed.

Introduction of change

Of particular significance in aiding the introduction of new technology in this Company is the market situation and the industrial relations climate within the firm. The company, which is relatively young in its attitudes and age structure, appears to have developed a very good working relationship with the Trade Unions who have accepted the need for change. Although there is no comprehensive 'New Technology Agreement' as such, the Unions have accepted that the use of new technology is vital to the firm's survival and are prepared to work with the Company over its introduction. In respect of the FMS system at Crewkerne, advanced warning and consultation with the Unions took place at least 12 months in advance and because of demand for its products the firm was able to guarantee that no redundancies would occur as a result of its introduction.

Staff for the new factory were recruited internally on the basis of volunteers. The Unions had accepted that the new system would require changed work practice and it was a classic example of a fully flexible cell manufacturing approach. It demanded, in the Unions opinion, a high degree of flexibility, co-operation and team work and while there was less use of individual skills, the jobs were more interesting. The Trade Unions agreed with the Company that this was the way to go.

In practice, it has tended to be the younger, more highly trained employees who have transferred to the new factory and who have found the computerized equipment and new style of working more easy to accept. Most of them are skilled craftsmen having served a Company Apprenticeship. While a number moved initially for domestic reasons, many were attracted by the opportunity to learn new skills and be involved in the development of 'the factory of the future'. While many had severe reservations and anxieties about the change, only one person asked to be transferred back and I was told by the manager that the majority would not wish to return to the old methods and this was confirmed by the work force.

The timescale for this type of development is quite long in that it has taken more than two years to get the system fully developed. But in the company's experience it has been system problems and programming the machines successfully which

have presented the major hurdles to overcome. Possibly, because of this, the emphasis in terms of involvement in the planning process has come from the technical functions. The project team planning the change and new system primarily comprised production engineers and software specialist with external help from Bath University under the chairmanship of the Manufacturing Director. There was no direct involvement by Unions or shop floor, or for that matter by other functions such as Personnel or Industrial Relations, or from the design side.

Results and benefits

To an outside observer the results and benefits of the new system have been very impressive. Although the company was reluctant to disclose financial information, the result of the new systems can be summarized as follows:-

i. The throughput, or lead time, for completion of products has been reduced. In the case of the current component, lead time using conventional techniques would have been 4/6 months and this has been reduced to 14 days.

ii. Work in progress and inventory costs have been substantially reduced.

iii. The system is more cost effective than a traditional factory.

iv. The system saves substantially on set up times and as a result of the reliability of the equipment and planned maintenance the factory achieves a very high 'up running' time for the engineering industry.

v. The jobs in the system appear more satisfying than in a conventional machine shop and this appears to improve the motivation of the staff concerned.

vi. The form of work organization chosen has enhanced co-operation and the feeling of team work. People more readily identify with the production of the overall performance of the factory.

vii. The computerized system and style of management chosen permit a relatively high degree of involvement of the work force in problem solving and managing the operation.

Observations and analysis

While many specific points have arisen from the description of the flexible manufacturing systems case, a number of more general observations can be made about it as an illustration of what is possible in terms of job and work organization design in the introduction of new technology.

❑ Business and manufacturing strategy

Comments were made in the case study about the changing environment in which manufacturing industry finds itself today. In many industries apart from engineering, an organization's competitive position depends not only on factors such as price, but increasingly on factors such as quality, consumer choice, product design and diversity, speed of delivery and back up service. These criteria, rather than being based on efficiency, or use alone, put a premium on overall organizational effectiveness and meeting the customer's needs.

To be effective in such a dynamic and diverse environment and market place pressure is put on the organization's flexibility and ability to respond to changing customer demands. Thus, to some extent, if organization and internal environment mirror the external environment this then gives the company a competitive advantage.

This means that the design of the organization needs to be seen as a strategic issue central to the effectiveness and survival of the business.

❑ Technological choice

The case also provides an illustration of the choices that are possible in the disposition of technology. Until comparatively recently, the assumption was often made that technology is finite and that all the other variables including people and work organization would fit round the technology. However, developments such as at

Volvo and Saab challenged the assumption of *'technological determinism'* and demonstrated that options and alternatives were possible which might better fit some of the other variables involved, eg people.

The use of Group Technology in this case is a further example of how the grouping of related machinery and equipment in a family or cell like situation can, apart from creating considerable operational advantages, now provide a sense of task identity and involvement in the whole process that traditional and functional forms of organization have found it hard to achieve.

❑ **Decentralization and information control**

The use in this case of computerized systems of information and management also demonstrates what is possible in terms of both decentralization of control but also in the integration of functions and activities. As opposed to large numbers of specialized staff being employed in production control and scheduling, these functions were decentralized to the operational teams of the manager and the work group. This, plus the inherent flexibility of the computer controlled machine meant that a high level of local autonomy on production, planning and control was possible, considerably aiding the flexibility and responsiveness of the system.

❑ **Smaller autonomous units**

Turning from technology to the question of organization structure, the use of a smaller decentralized unit does appear to have significant advantage particularly in regard to communication and the sense of involvement of the work force in the organization as a whole. The feature was recognized in the earlier work on socio-technical systems and th e opportunities existing for 'organizational choice' (Trist and Bamforth 1951).

This form of decentralization is made possible by the disposition of the technology and by the computerized information systems. The fact that the unit can have all these facilities and resources required to make a complete product means that it can be both geographically and organizationally relatively independent of other parts of the organization, whereas with a traditional functional organization the various

specialized departments need to be closely related to facilitate communication and the movement of work. Also the decentralized computer information system means that the majority of management decisions and control can be taken at the base level.

❑ **Teamwork**

Although chosen for primarily operational reasons the decision to adopt a flexible pattern of working and team work does seem to have influenced peoples' reaction to their job in a very positive way. Although the advances in technology may have detracted from their manual skills, a lot of discretion had been retained regarding the organization of the work and this, together with the variety of working at different stages of the process, helps to achieve a high sense of task identity and involvement in the total operation. This, as was suggested in my reactions to the case at the time, does suggest that group forms of organization may often be more appropriate to computer based systems of manufacture than traditional forms of work organization.

❑ **Employee and trade union participation**

Finally, the case does demonstrate the importance of the involvement of employees and their trade union representatives in the change process. In this instance the attitudes of the trade unions towards the introduction of new technology and the changes in work organization required appeared to be influenced by their involvement and consultation on the strategic issues and developments of the firm. It is difficult to see how trade unions can be expected to accept the extent of changes r equired by new technology unless there is involvement at that level. The threat to the traditional role of trade unions of maintaining the employment of craft and skills of their members means that they can have legitimate and well founded concern about the introduction of new technology and management's objectives in doing so. Only very full involvement and consultation with regards to the objectives of the change and the approach to its introduction are likely to overcome the natural resistance and fears that trade unions and their members may feel.

These issues and the question of employee involvement in the development of their new systems will be more fully illustrated by the next case study on Automated Loom Building.

Summary

The value of this case therefore is that it shows what is possible in terms of achieving a satisfactory match between human and technological needs. Although, to some extent, perhaps unconsciously and largely for operations rather than social reasons, the case demonstrates that options and alternatives are possible in the disposition of both the people and the technology. In this case, combining what was in effect a group form of organization with a group form of technology enabled people to feel involved and responsible despite the advanced levels of automation concerned.

While this case has demonstrated a number of positive factors that can help to achieve this result, it still leaves the question as to why, in other situations and applications, similar results are not obtained. Analysis of the subsequent cases in Part III will help to answer this question.

CHAPTER 5 - AUTOMATED LOOM BUILDING

It Takes Two to Tango - Participation in Job and System Design at Westland Helicoptors

The second case study: origins and involvement

The value of participation and the involvement of all parties in the process of job and system design is evident from the next case study on the introduction of automated loom building at Westland Helicopters in Yeovil. My involvement at the time, as Supervisor to the Project Manager, Barry Mills, who had registered for an M Phil gave me the opportunity to form contacts and close working relationship with the Research and Technology Division of Westlands from the autumn of 1984. In effect, Barry Mills became the prime informant and a subject of the study as he was the leader of the change.

The Research and Technology Division, while heavily based on developments in design and manufacturing technology, had recognized that changes in these aspects had important human and organizational consequences. Indeed, their objective (raison detre) was defined as the promotion of technological and organizational '*change*' in the Westland Group.

The Company, which at the time employed some 11,500 people at Yeovil, Weston-Super-Mare and Milton Keynes, had had an interest in employee involvement for some time. Trade Union consultation took place through an unlikely named, but highly influential, Lands and Building Committee and an Employee Involvement department which was headed by an ex-convenor of the factory and was quite separate from the Personnel Department.

The Research and Technology Division which researched optimal manufacturing techniques, systems and operational structures for all parts of the Westland Group, sought to work in an interactive way involving all parties at all levels in the process of change.

Having identified an opportunity for the use of new technology, they then researched and demonstrated this to potential users. The demonstration provided the opportunity to involve the potential user and gain their commitment to its development. Therefore, their intention was for the user to take up the process of development with R & T in a supportive role.

While R&T-start their projects from a technological base, they seek early recognition of the opportunities for systems integration and organizational benefits. Thus, it was recognizsed in R & T that most projects have technological and organizational implications both horizontally and vertically and depend for their success on how much people can work together. However, it is perhaps important to note that while this fact was clearly recognised, it did not appear to be reflected in the allocation and distribution of their resources. All the staff involved were technology based and although they had some awareness of the issues were not trained in psychology or the behavioural sciences. This, in part, explained my own involvement as an external resource to provide some input on job design and organizational development.

This case study is, therefore, interesting on three levels:

- Firstly, as an example of technological change and automation in manufacturing and the fact that choices and options are available.

- Secondly, as an illustration of participation, in job and system design in practice.

- Thirdly, as an example of organization development and the role of technologists in stimulating and organizational change.

Data collection:

In terms of the research and data collection, my role in this case was one of advisor and observer. Through my contact with Barry Mills I had access to visit the existing loom factory, study the traditional methods of loom building and talk to the loom builders themselves. Also through my involvement with R & T I was able to obtain technical background information on loom technology and the issues involved in its development.

As a result of these contacts I had the opportunity to follow through the development of the automated approach to loom building. This enabled me to visit the R & T Department to talk to the loom builders involved in the loom building improvements. This they decribed as 'job design' without really realising that this was an acknowledged discipline.

Unfortunately, although I sought access to conduct more detailed analysis of the changes to the job characteristics as a result of introducing the new technology, this was not possible, due to trade union sensitivity. However, informal discussions enabled me to get some useful impressions of their reactions to the proposed system (see page 65 for detailed discussions on reactions of the loom builders).

Apart from my own involvement and researches, material for this case study was also drawn from a paper presented by Mills, Project Manager in Research and Technology at Westlands at the 1st International Conference on Human Factors in Manufacturing in London, Mills (1984).

The art and mystique of loom building

Modern aircraft and military helicopters in particular have a large amount of electrical and electronic equipment for aircraft and weapons control and guidance. The wiring looms which power these various instruments and pieces of equipment are therefore very complicated and this is reflected in the length and complexity of the manufacturing process.

Traditionally, wiring looms have been built manually by skilled electricians assembling the looms on large boards standing vertically, often 15 - 20 ft in length and 10 ft in height.

This is a detailed and laborious task and it can take as much as three to six weeks to assemble some of the more complex looms. Because of the requirement for accuracy and attention to detail the work is self paced and no bonus schemes operate. The work, though painstaking, appears leisurely but requires considerable skill and patience. With the more complicated looms involving up to 2500 cables of 12 metre lengths, it takes a qualified electrician of average skill up to four years to develop the experience and skill level required to assemble the loom.

The first stage in manufacture is when the cables are cut to length in a cutting room largely staffed by semi-skilled female operators. Each cable is then marked with an alpha-numeric identification which is printed on the plastic sleeves which are slipped on to the end of each cable.

The cables ar e then handed to the loom builder in kit form, together with the fittings required such as pins, terminal plugs and sockets. The operator then assembles the loom on a loom board and working from a drawing forms the cable into bunches, laying individual cables along designated routes, adding and subtracting from the bunches, strapping the wires together, cutting to length, stripping the insulation from the cable ends and crimping the terminals into place.

Further complications arise from the use of some 70 different cable and terminal types, many of which require the use of dedicated hand tools.

The most time consuming part of the job is the sorting process, identifying cables, sorting them out from a bunch and choosing which cable to break out from main bunch.

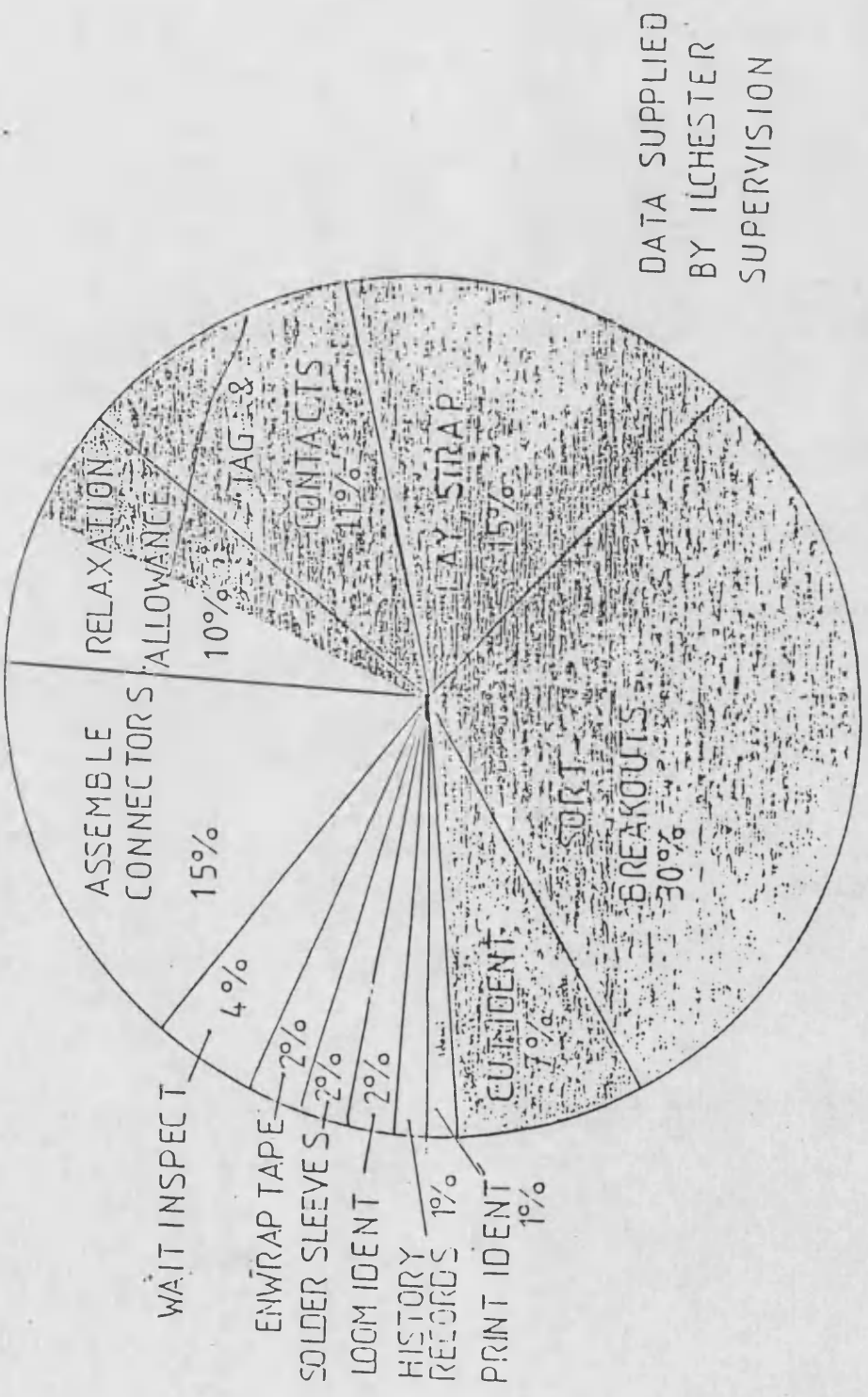
An analysis of the elements of the current manual loom building process and the average amount of time spent on each task is shown in Figure 9.

The technological menu

Increasing competition in the aircraft industry led to pressure of costs. Continuing developments in aircraft design involved still greater use of electrical/electronic equipment and increased the importance of loom manufacture. In these circumstances, the cost of loom building assumes greater importance and the company was forced to look at alternative approaches to loom manufacture. Studies of the anticipated future work load for the loom shop showed that a 40% increase in manning levels could be required over a period of six years if the current manufacturing methods were not changed. This knowledge, added to opportunities that were evident from the study of the loom building process in Figure 9, provided the incentives for an investigation by R & T into the potential for mechanization and automation in the loom building process. This study revealed that while the job was quite skilled and complicated, it comprised a number of discreet operations, many of which were capable of mechanization.

Following further investigation and desk research methods of mechanizing most of the operations were identified and the investigation stage culminated in the production of a menu of *'candidate'* manufacturing techniques which would then be offered as demonstration of their potential to the user. The demonstration effectively showed the options and alternatives that might be available in terms of loom building technology. Apart from demonstrating individual stand alone, items and pieces of equipment, methods of mechanical handling of the reels and cut lengths of cable were also demonstrated. Firstly, they demonstrated schematic alternatives and options as to how these items would be grouped together and the potential for computer control of the process.

Figure 9 Cost Breakdown Based on Lynk Peel 701 01 L



Consideration of the staff of the schematic layouts highlighted a number of important points.

- That some tasks arising out of the present loom design could never be mechanized and mechanical methods would always be interspersed by manual tasks.

- Different looms required different combinations of technology and therefore an important part of the task of data preparation would be the interpretation of loom design and selection of the appropriate technology and manufacturing process.

- Job design and the involvement of the user, i.e. the loom builders with their experience and knowledge of the process, was as important as the design of the technology.

Participative job and systems design

The approach adopted to job design in this case needs to be set against the background and culture of the company and its approach to participation and employee involvement. As mentioned earlier, the company had a declared policy of fostering the active participation of managers, trade union representation and all employees. Apart from a Joint Management and Trade Union Group and Company Council, the Employee Involvement Department seeks to develop awareness and participation in company issues at all levels.

As the project manager, described:

> *"Over recent years the representatives of bargaining groups within the company have increasingly balanced their pursuit of the traditional issues of finance and working conditions with an interest in furthering the survival and competitiveness of the company and the quality of the working lives of their employees."*

This philosophy of involvement was then extended to the introduction of new technology and the intention was to use the loom building project as a pilot study as the following further quotation demonstrates:

> *"In seeking the involvement of shop floor personnel in the development of this technology, the Research and Technology Division proposed and obtained agreement to the adoption by a Company Council sub-committee of the role of overseer of the exercise - so that the potential benefits might be recognized and the concept, if proved effective, might be applied elsewhere."*

The realization - the birth of job design

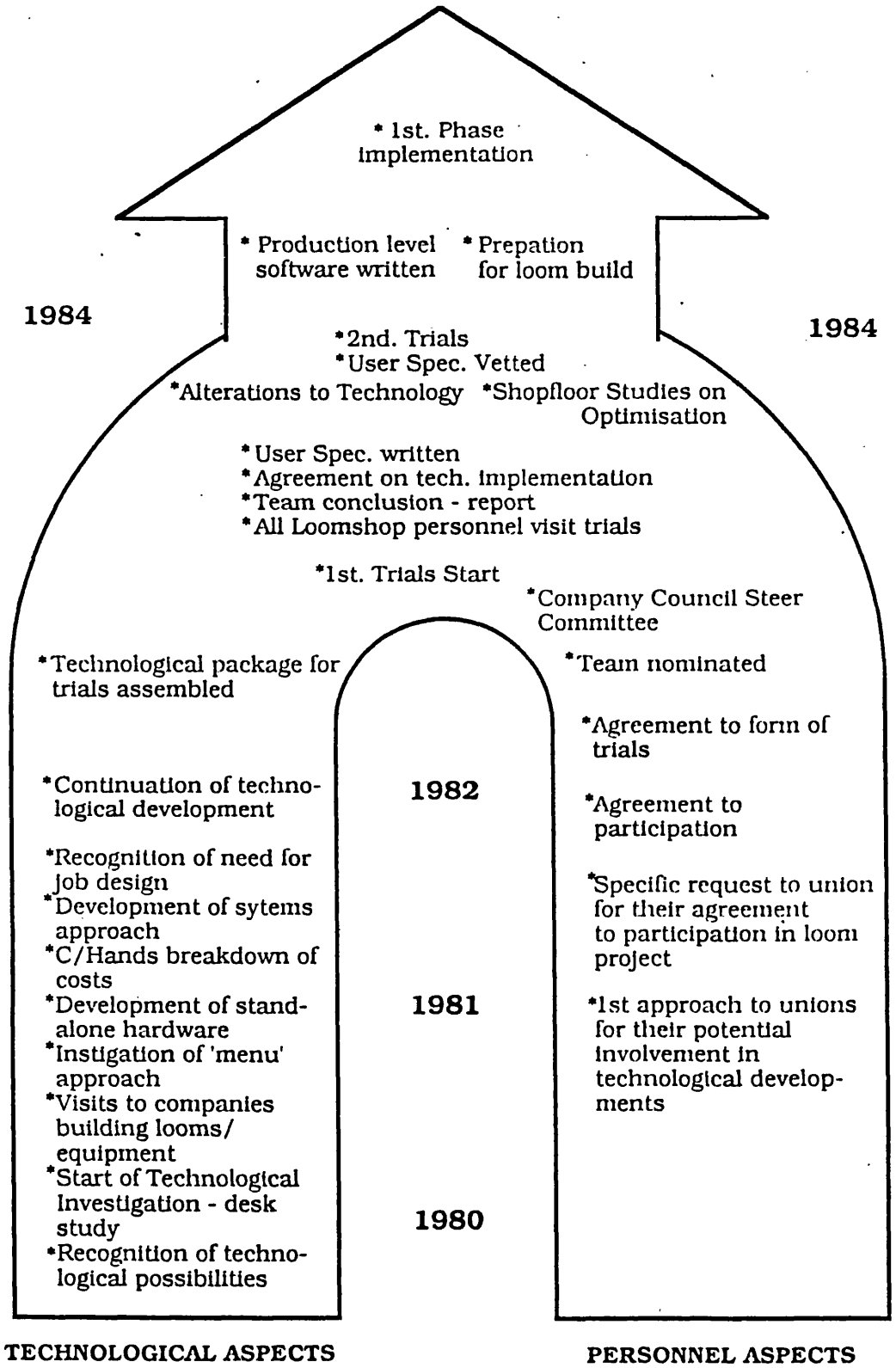
From what began, in the early 1980's, as a classical engineering approach to the development of manufacturing technology, the loom building project became a *'classical'* illustration of participation in job and system design. (See figure 10, which summarizes the phases in the development.)

The Research and Technology Department openly acknowledged that its initial approach had been one where engineers and work study specialists had examined the needs and opportunities for change in loom building and the scope for mechanization and automation of the tasks. The approach had been on a *'menu'* basis where the mystique and skill of the task of the loom building had been systematically broken down into its constituent parts (eg *'cut wire'*, *'strip wire'*, *'lay wire on firm board*, etc) and to demonstrate how these could be mechanized.

However, the stage was reached where the various items of hardware could be drawn out on a single sheet of paper and arranged in a *'cell'* form and to give the drawing scale they included figures of people. This, as the quotation below from Barry Mills explains, prompted them to consider the working of the operators in detail.

> *"Despite having adopted the classical engineers (people-less) approach to loom manufacture, we were sufficiently aware of the impact on the working lives of the loom builders to want to design their roles as part of the*

Figure 10 Phases in Development of Loom Technology



Ref. Mills (1984)

manufacturing system. We coined the term 'job design' before realising that this was indeed the chosen title for the discipline of designing the job content and function of peoples work lives."

The grand design - a policy for future loom manufacture

The stage had now been reached where R & T, with the manufacturing division, could now propose the development of a policy for loom manufacture in the future. This policy consisted of two separate inter-related strands, one concerning the technology and the other concerning the people.

Regarding the technical development, as a result of their research, the company were now proposing an implementation of new technology in three phases:

Phase I - Comprising manual loom building using computer based instruction to the employees and automatic cable sorting.

In this process a continuous filament would be generated by a laser method and cut to length. A VDU would then take the operator through a step by step building sequence, eliminating the tedious sorting task, thereby offering a 30% improvement in productivity.

The VDU screen would provide data showing the operator how to route the wires similar to the bunch sheet, which gives *'breakout'* data on the existing manual system. (See Figure 11)

Phase II - Involves manual loom building as outlined above, with the addition of automatic stripping and crimping of the majority of connectors.

In this process the machine would draw off the cable, recognizing the end marks, cut the length, transport it to a terminating and inspection machine. The operator would then be supplied

with a range of predetermined cables. This system, which was the preferred R & T option, would take the form of a manufacturing cell. (See Figure 12).

Phase III - Integrated systems, which will consist of automatic cable laying machines, employing a robot and computer controlled loom design and manufacture.

In this system the cables are automatically cut to length, mechanically transferred via a laser stripper and automatic termination machine to a high speed wire laying machine. An automatic machine prepares the forming boards from universal components and straps the bunches subsequent to laying. (See Figure 13)

These developments were seen as a long term strategy and it was anticipated that full implementation would be over a six year time scale. However, the benefit in terms of increased productivity would be considerable and the time taken to build a loom would eventually be reduced from six weeks to four days.

However, in proposing these developments the Research and Technology Division recognized the essential contribution required from the shop floor where detailed knowledge and experience would be required to complement the technological possibilities.

Under the auspices of the Company Council and the sub-committee that had been formed as a Steering Group, agreement was obtained to release four shop floor operators with a chargehand, to be seconded to work with the R & T Division for a period of three months in the development of the new systems. The ultimate objective of this exercise would be the production of a User Specification as a basis for the future manufacturing process.

Figure 11 Computer Aided Loom Manufacture

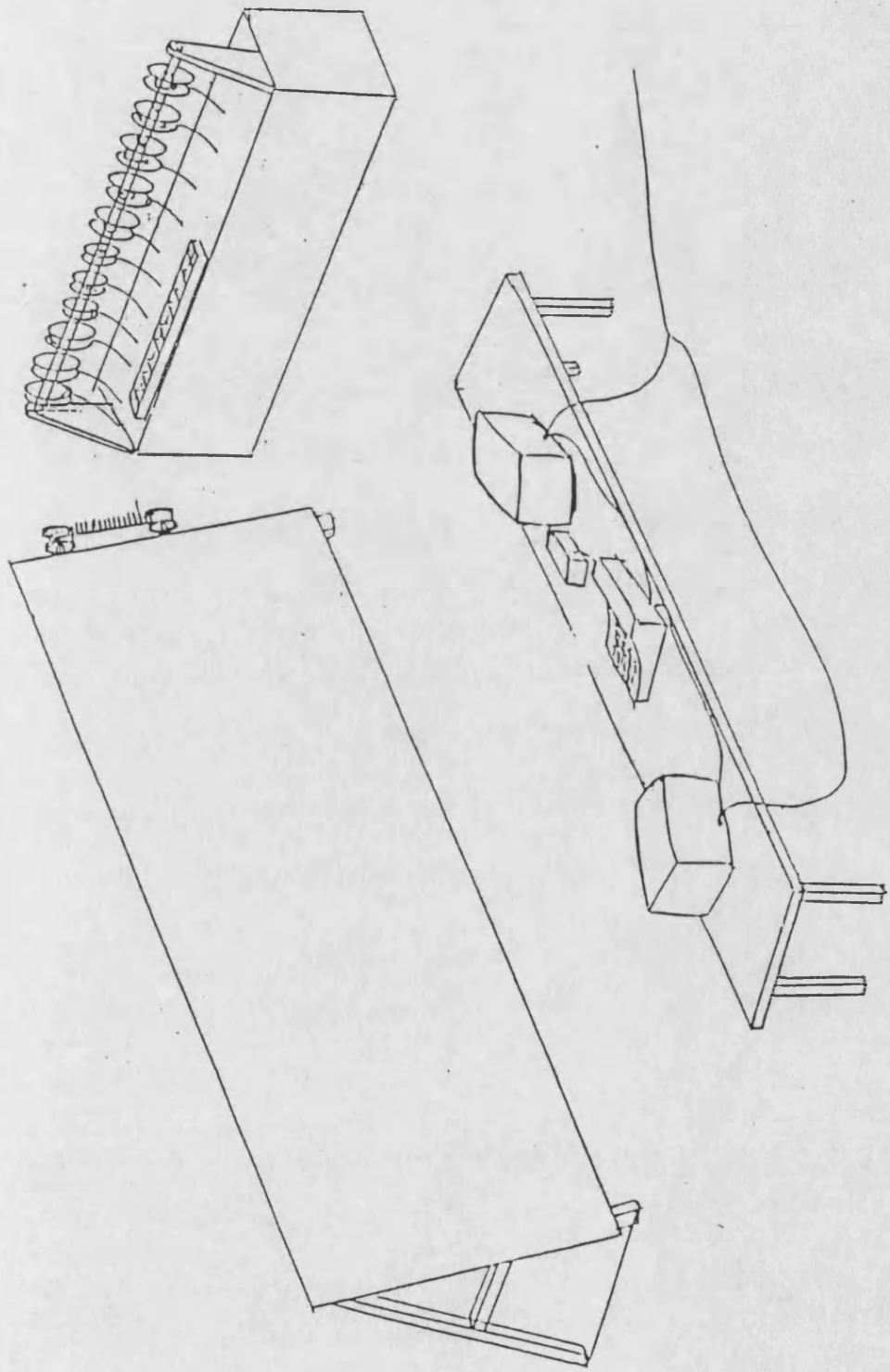


Figure 12 Scheme for Semi Automatic Loom Shop

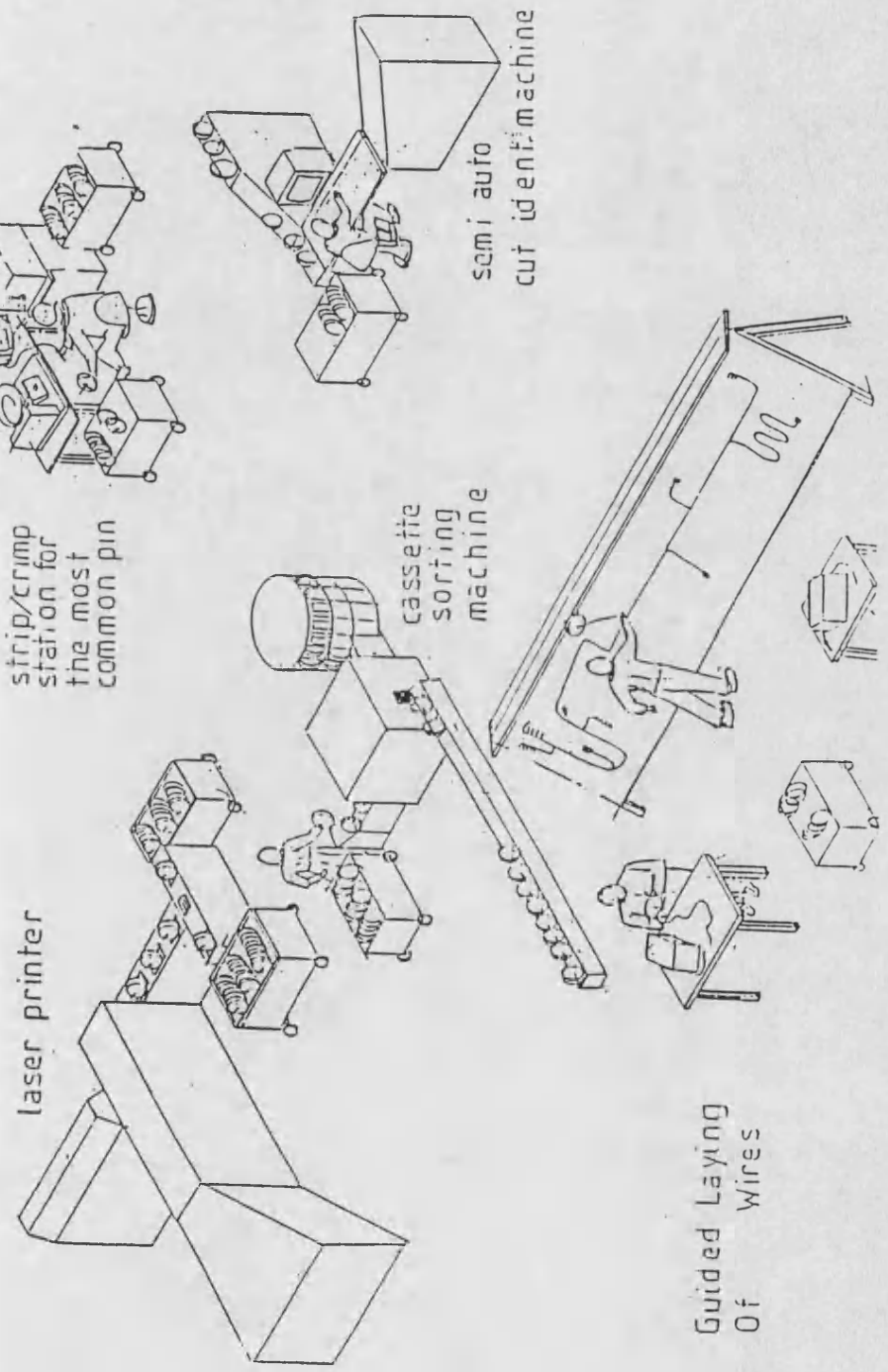
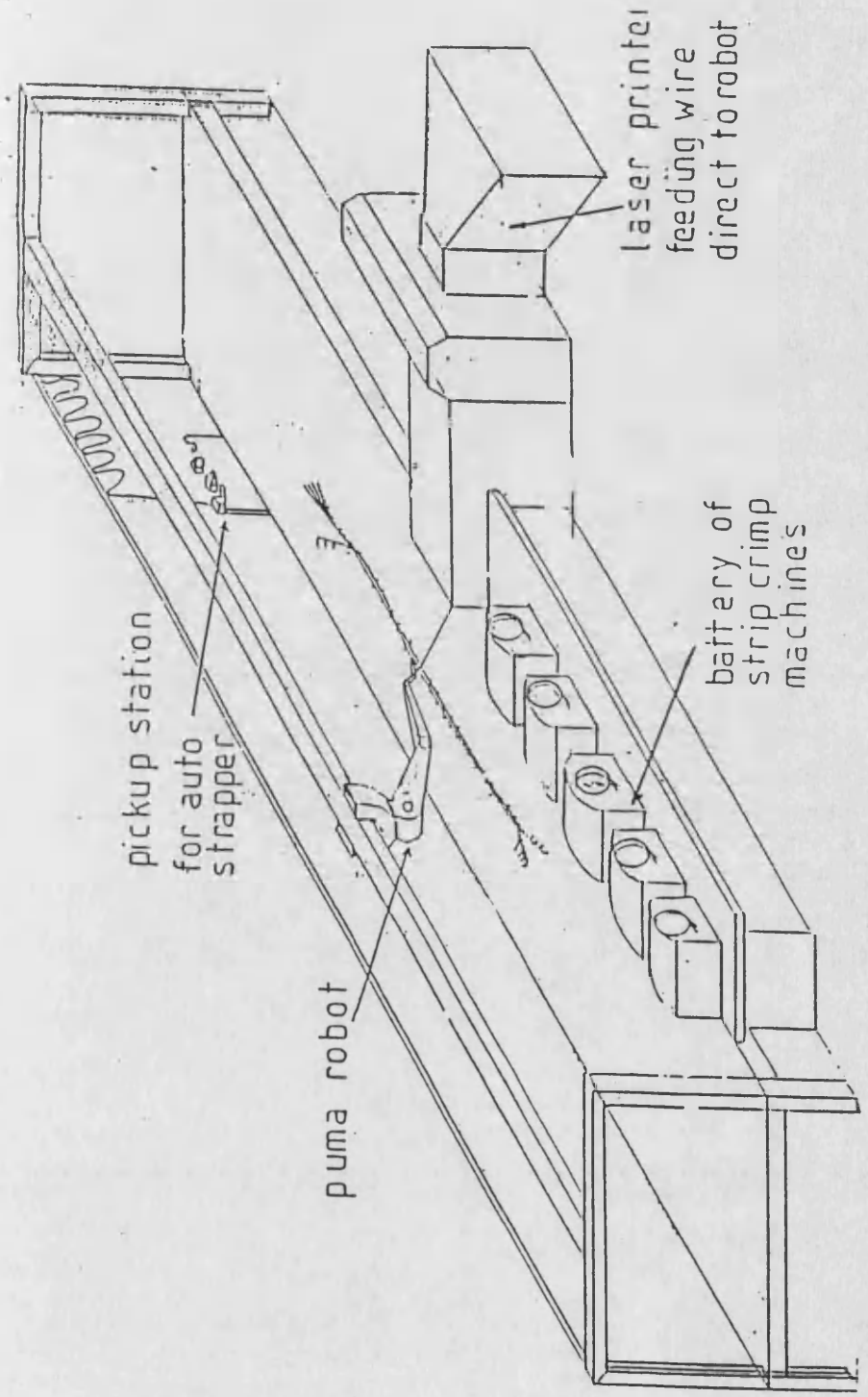


Figure 13 **The Lansing Bagnall System**



Playing the game - job design in practice

The participants in this '*experiment*' were nominated after consultation. The shop superintendent nominated a chargehand to participate and the shop steward nominated four operatives. In addition to this group, technologists from R & T were available to give support and adapt the hardware and software where required. Staff from design and quality were also identified to give specialist input and advice at regular intervals.

The development exercise which took place in the R & T building started with a three day introductory programme in which presentations were given on all the projects and on the work completed during the investigation phase.

Great emphasis was placed on the fact that the work was of an experimental nature and that the equipment and various systems were to be viewed as '*candidates*' and alternatives, rather than prescriptions for a future loom shop.

Following the introductory phase the group's task was to operate the various items of hardware in a '*stand-alone*' mode to familiarise themselves with the equipment and provide feedback to R & T on their reactions and preferences.

This was followed by a loom building phase in which members of the group took turns to perform the various tasks and observe. The building of the loom was accompanied by breaks in which suggestions were discussed, alterations made and feedback given to the design and quality staff and to line management.

Reaction of the loom builders

During my time at Westlands I had the opportunity to visit the existing loom shop and also to talk to those loom builders involved in the experiment and developments in R & T. At this stage, while the people in R & T were still exploring the options and alternatives, staff in the main loom shop had quite strong views on what was proposed.

My first discussions were with the loom builders and other staff in the existing loom shop. I talked to the female operators who were cutting and crimping the wires manually in preparation for loom assembly. Their jobs which were very repetitive would be replaced by the new system which would carry out these operations automatically.

However, main discussions were with the skilled loom builders who assembled the looms, sorted out the wires and laid them out on the wiring looms.

These discussions with the loom builders revealed both positive and negative reactions to the proposed changes. Their main concerns were that automation would result in deskilling and the creation of what they described as *'monkey jobs'*. However, they recognized that the proposed system would help to create more orders and that they would get satisfaction from more involvement in the total business.

The current method of loom building was a one man job and was particularly boring and there were frustrations with lack of parts and shortages. However, the individual was in charge of the building of the loom whereas they now felt that the computer was controlling them. They felt very strongly that man needs to control the computer and that they should determine the work order.

In describing their work with R & T the operators explained that while opportunities for mechanization had been identified, there were some parts of the job that could not be automated. Also, it is the organization of the work that takes the time rather than the work content. There were also many operations that had to be done to the wire before it would be released to the operator for laying.

However, apart from the issues and concerns expressed by the operators, it appeared that management also had concerns about the introduction of the new system. The manufacturing manager, apparently, was fearful of *'inanimate'* computer control of the whole system and managers feared the loss of their control to the computer programmers.

These reactions led those concerned with the experiment to conclude that it was the human factors rather than technical problems or hurdles that were determining the pace of change. It was explained to me that, as a result of the user involvement described and the reactions and suggestions of the loom builders, the group had decided to opt for the less ambitious system involving the supply of a continuous filament of wire, together with a VDU and printed instructions how to lay the loom. With the bunching system the operator had to spend a lot of time sorting the job out, whereas now, with the new system, they could build up a loom at a walking pace pressing the computer punch button to get their instructions.

The selling point of the new system was the speed of laying down the wire in a continuous filament. The next stage was to get the loom off the frame and to cut, bare and crimp the wires and they were examining various automated machines to do these jobs. For this, they felt they needed the operators involvement - not only in the detail, but also from a policy point of view and that this should be to consult with them rather than to tell them what was required.

Unfortunately, union attitudes towards external parties meant that I was unable to obtain quantitative before and after measures regarding the changes to the job characteristics of the loom builders as a result of automation. However, from an informal discussion, I was able to obtain some of their reactions and concerns on these issues.

AUTONOMY - as previously mentioned one of their main concerns was to retain their autonomy ie not to be computer controlled. They therefore suggested that they should receive a computer tab or printout so that they could decide themselves which jobs to do and when.

VARIETY - similarly on the question of variety, they were very concerned about being stuck on one part of the operation. For example, they questioned why they couldn't install the completed harness in the aircraft and one is bound to ask why not!

TASK IDENTITY - this would also be a reflection of the need to maintain task identity and involvement in the whole process.

TEAM WORK - some interest was also expressed in the possibility of having more than one person working together on a loom. They felt that people were still basing the design on one person where there might be scope for more teamwork.

FEEDBACK - finally, regarding feedback, they felt that the computer based system did mean that they obtained quicker feedback on results and progress than before.

Clearly these suggestions and reactions had quite wide implications for both the organization of the work and the technology. While a number were incorporated into the first phase of the development, eg the printout suggestion, retaining operator control, others could influence the shape of the further phases of development, eg Computer Aided Design and Manufacture (CAD/CAM) and operator involvement in installation.

CHAPTER 6 - DISCUSSION OF THE LOOM BUILDING CASE

The loom building project was, in many senses, both an eye opener and a watershed, not only for Westlands, but also in terms of my own research. Whereas the Crewkerne FMS case demonstrated what can be achieved by alternative forms of work organization alongside the new technology, the loom building case showed me something about how to get there. Some of the points for Westlands and for myself from this project are as follows:-

The technology menu - one of the first points to emerge from this project is the concept of choice regarding both technology and organization. Regarding technology, the R & T staff recognized that there were several options and alternatives that could be offered to the user. These were seen as '*candidate* ' technology rather than prescriptions and that ultimately it was for the '*user* ' to select what was appropriate and acceptable from the '*menu* ' to satisfy their needs.

User involvement - fundamental to the *process* of the introduction of new technology in this case was the concept of '*user* ' involvement. The user in this case included not only management, but also the trade unions and the shop floor. User involvement was seen to be necessary not only in terms of policy and at a strategic level via the senior management and the trade unions, but also at a detailed and operational level via line management and the operators themselves.

Job/system design as a development process - approached in this way the development of loom manufacture was as much a '*process* ' of development as of design. While the company acknowledged that its initial approach was that of '*classical engineering* ' and '*technological determinism* ', they equally acknowledged the ideas and suggestions of the shop floor and indeed felt that their contribution was essential to the development of an effective system.

Participants in the process - the loom building development group with its composition, connections and the umbrella of trade union support gave valuable clues as to those that need to be involved and have a stake and a contribution to make to the development process.

Shop floor influence/participation in job design - in analysing the loom building project, Barry Mills comments on *"the belief of t he loom builders that they could improve the quality of their jobs"* they understood the potential of computers to eliminate the more boring elements of their work (they didn't like the *sorting task*)

In this they proved right: they were able, to a large extent, to influence the form and function of the new work system by the input of their specialist knowledge and by tailoring the user specifications to suit their needs. *"To this extent"*, Barry Mills comments, *"the project was a successful job design exercise"*.

The first case demonstrated that there are options and alternatives in both organization and technical design. This case demonstrates the options and alternatives resulting in the process of technological change and some of the elements required in a strategy to achieve a satisfactory match between human and technological needs. Again, they learnt the hard way, but they actually leanrt from the lessons and their experience influenced their future approach to technological change. They recognized that, as technologists, they needed to be aware of the human and social implications of the changes they were planning and incorporated this into their developmental strategies.

> *"We began researching alternative loom building techniques and systems in the classical engineers way - we sought to mechanise. But, fortunately for us, our realization that a successful first phase required the participation of people who knew much more about how looms are made than we ever would, coincided with the discovery that they wished to be involved in the development of future work systems."*

This realization stimulated a major change in the approach of R & T to its work and for the company to reconsider the potential of technology and job design for its future organizational development.

Role of technologist as a change agent

One of the most interesting features of this particular case study was the role played by Barry Mills at Westlands and the changes in outlook and personal development which occurred as a result of his involvement in the introduction of new technology.

Barry Mills came from an Engineering background and whilst not highly qualified, (City & Guilds Certificate) developed into a position of considerable responsibility to Project Manager in the Research and Technology Division. He was quick to recognise the significance of the work he was undertaking at Westland and sought opportunities to project and explore his ideas. He also registered the work for a CNAA M Phil and has more recently converted this to a Phd.

His involvement with R & T, and in particular with the loom shop project, appeared to influence him as an individual profoundly and he sought to extend this influence to others in the organization from his role as Project Manager in R & T.

Following the loom project, he put forward proposals in Westlands for a radically new approach to business improvement, cost reduction and technical change, involving both job design and organizational development. These proposals amounted to the development of an a lternative strategy to the conventional approach to change which could be applied to a variety of potential problems, projects and developmental opportunities. These included for example the development of manufacturing Ilôts, employing group technology concepts to the use of job design at management level. Important and far reaching though these potential projects might have been, of more significance was the suggested approach that should be adopted to their implementation (see Appendix 4).

Changing business environment

A number of factors came together which highlight the relevance of job design and organization development to business improvement and the use of new technology. Westlands had traditionally operated in a cost plus environment where there was a lack of aggressive commercialization and of targets for both design and cost.

However, increasing international competition, the opening up of the civil helicopter market and the introduction of fixed price contracts were forcing the company to become more competitive and cost effective.

The company responded to the changing business environment by transferring its sales operation and creating a marketing division and market orientated business group. Cost targets and reporting structures were introduced in order to control operating costs and emphasis was placed on the potential of new technology for improving cost efficiency.

They also r ecognized its threat to their autonomy and vigorously sought to preserve this in the way the new system was designed. Like others such as Howard Rosenbrock (1981), the case does provide evidence of how computers can be used to provide staff with information to enable them to control the process more effectively rather than be controlled by it.

Technology as a catalyst for change

The case also provides valuable evidence of the potential of technology as a catalyst for change. Barry Mills describes how the operators were initially sceptical that machines could ever do their jobs. However, he felt their immersion at R & T made them recognize the inevitability of technical change and of the temporariness of their current job situation. This he suggested helped in their acceptance and co-operation in the change process.

Thus, as Barry Mills suggested, we need to recognize the capacity or '*latent heat*' of technology to facilitate change through a process of unfreezing existing attitudes, change and refreezing.

On this latter point it may well be that while some consolidation is necessary to accept and work with a new situation, it is dangerous if attitudes do become refrozen. Perhaps what is required are people and forms of work organization which are capable of continuous adaption to change and organizational renewal. This clearly calls for very different skills and attitudes amongst those involved in the process and a distinct departure from the traditional emphasis on narrow technical skills.

Role of organization development in technological change

Analysis of both these cases does highlight the relevance of organizational development to the introduction of new technology.

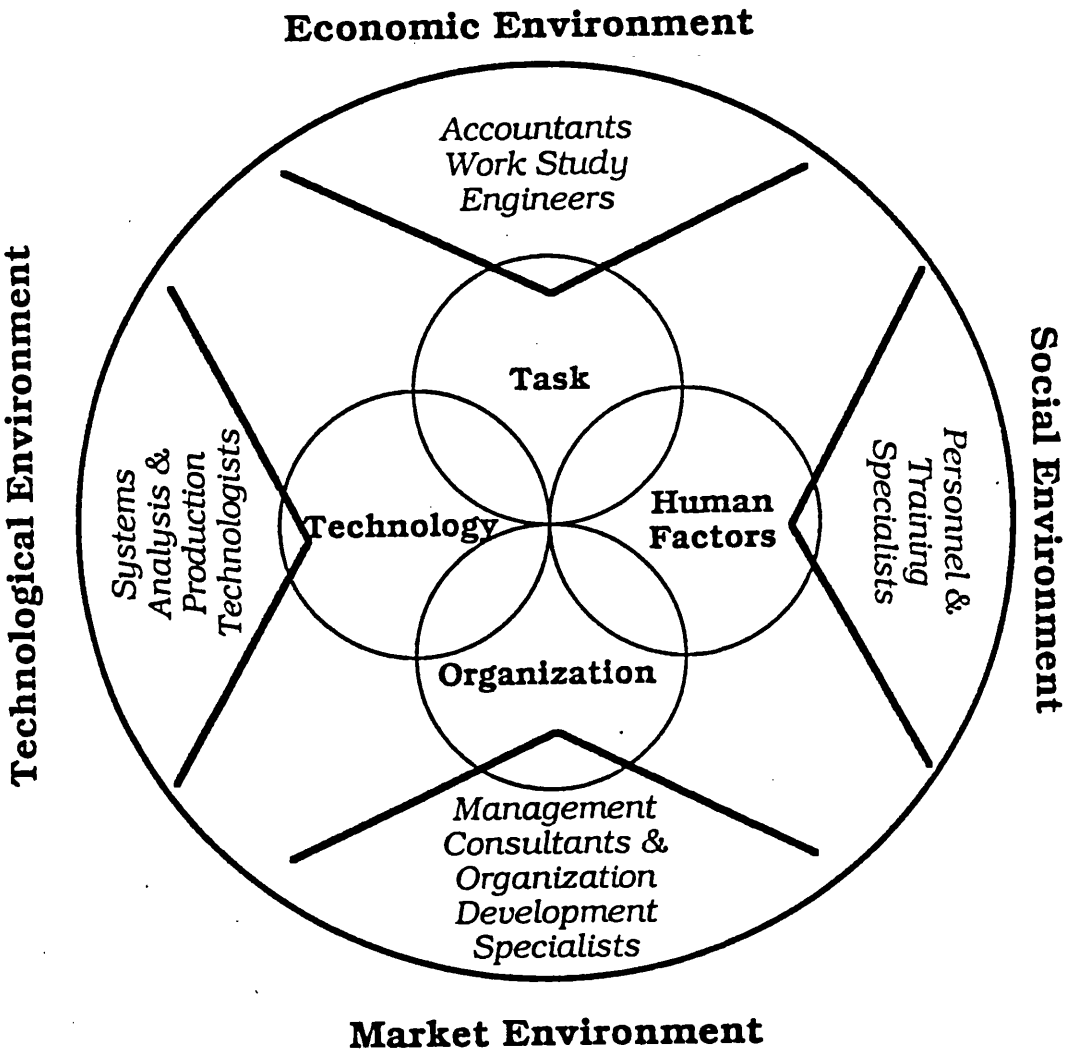
We need to recognize the organization as an open socio-technical system subject to pressures and changes in the external environment. It is comprised of overlapping, interlocking sub-systems which helps to explain the issues involved in the introduction of technological change. Each specialist is, to some extent, working as a change agent between the organization and its environment (see Figure 14).

Thus, as can be seen the personnel specialist endeavours to adapt the organizational, personnel and employment policies and practices to changing requirements and demands. Technologists attempt to adapt an organizations manufacturing and information systems to the latest technology.

The conventional 1960's view of OD was that the OD consultant would intervene largely on the organizational variables and then changes would follow in the other three. However, as Clark (1972) and others point out, OD has been criticised for assuming that it is possible to introduce change successfully by intervening on one variable alone. For successful change he argues that analysis of the requirements for change should be conducted on all the relevant variables. Thus, while change may be initiated by changing technology one must analyse and take into account the corresponding changes that may be required in terms of the task, the people and the organization.

This suggests that change, rather than being seen as a specific isolated event, needs to be seen as a process of analysis and adaption, where communication and interaction and an understanding of each other's perspectives is essential. This certainly supports and reinforces the need for wider rather than narrow representation in the process of introducing technical changes and of an interactive and participative approach to the process.

Figure 14 The enterprise and its environment



Review of Stage II

My initial literature survey was very much concerned with the impact of new technology on people and their jobs and with the role of job design in its introduction. From this work I had found that while the effect of new technology could often be negative, this was more as a result of management assumptions and the way it was introduced, rather than as a result of the technology itself. From my previous work in the field of job design and from my knowledge of socio-technical systems theory, I had every reason to believe that the tools and concepts concerned could be applied in the introduction of new technology to good effect and that this could help to reduce its negative consequences.

The object of the first stage of my field work was therefore to find out how far this was possible in practice and whether one could achieve a satisfactory match between human and technological needs, while still fulfilling the economic needs of the organization. My study of the first two cases provided convincing evidence and dramatic insight as to what was possible in this direction. Although in both cases the results were obtained almost more by accident than design, they showed me that through the adoption of alternative forms of management and work organization and through the participation of those concerned it was possible to achieve a more effective match between technology and people's needs.

On the one hand, with the FMS case, it showed me that there were options and alternatives in terms of the organization of people and work and that group forms of technology may require group forms of organization. However, as the case study suggested, this has considerable implications for the role of management, structure and style for the organization as a whole. The needs and opportunities for a more decentralised form of organization with small, more autonomous units, can be facilitated by the developments in computer technology. This style of organization also provides a better 'fit' with the changing nature of the business environment with the emphasis on choice, flexibility, speed of response, quality and service as well as achieving greater cost effectiveness. Thus, even at this stage of my research, the link between new technology and business strategy became evident to me.

However, changes of this type and magnitude are not easy to introduce. Apart from the problems of designing advanced technical systems the human implications for people and their jobs are far reaching. The second case on the Loom Building project provided me with invaluable insights of what was possible in terms of attitude change through the participation and involvement of those concerned. Thus the loom builders who had themselves recognised that they were involved in job design played a major part in the development of the new system and were able to incorporate their ideas and objectives into the eventual solution.

This reinforced my own contention that these changes need to be seen as a process of 'design and development' and that there are options and choices in both respects. How far these choices are recognised and adopted depends on the attitudes and assumptions of management and those involved in the process. These factors were in my mind as I approached the next stage of my field work.

PART 3

IMPACT OF AUTOMATION AND COMPUTERIZATION

CHAPTER 7 - AUTOMATION OF A PAINT SPRAYING PLANT
Job Satisfaction in Autonumis

Background to the third case study: origins and involvement

The opportunity to study this case arose in the summer of 1984 from my involvement and initiation of a Teaching Company Scheme aimed at assisting smaller companies to utilise the benefits of micro-technology. Of the four companies that participated two were involved in applying microprocessors to their products, one to their management and cost control system and the fourth to their manufacturing process.

The company, Autonumis, had a study conducted by a Division of British Leyland into the feasibility, of automating their paint spraying facility involving the use of a robot. Encouraged by the availability of a 30% DTI grant the Company decided to proceed and a Teaching Company Associate was appointed to join the scheme and work on this and other projects with the firm. Apart from involvement in the company, the Associates are also guided by tutors from the Polytechnic in this case by staff from the Engineering Department. It is perhaps significant to mention that also I was co-ordinator of the scheme, working out of the Management Department the Polytechnic determined responsibility for the scheme had to meet with a particular department, in this case the Engineering Department.

However, apart from my involvement as a co-ordinator of the scheme I was keen to maintain the academic involvement and saw the opportunity to study and hopefully influence the introduction of the new system as it appeared that it could be a very valuable example of the introduction of new technology in manufacturing.

Partially, as a resul t of my role as co-ordinator of the scheme, but also because of the good relationships I had already established with this firm, I was given very full access to study and observe the process. Unfortunately, the Associate concerned was moved on to another project before the planning stage was completed and, as a result, we lost some of our ability to influence what happened.

Data Collection

Data for the paint spraying case was collected over a period of 18 months from Spring 1984, from a variety of sources. In the first instance my involvement as co-ordinator of the teaching company scheme meant that I was able to obtain access to company information and reports on the proposed scheme. In addition, as tutor to the associate involved, I was able to obtain information and impressions from his involvement with the project. Apart from this I was invited to attend one of the planning meetings for the system.

Following this, I interviewed the Managing Director, Production Director, and Production Manager about their objectives and plans in introducing the new system. In addition, I was able to interview the consultant concerned with the robot and also the project co-ordinator to obtain their impressions of the project. Finally, I interviewed the existing paint shop supervisor and the operators to obtain their opinions about the new system and the advantages and benefits they felt it would afford.

With the consent of the company I carried out a survey of the existing paint shop operators, using the Hackman and Oldham Survey. I fed the results of this survey back to management (see Appendix 5). Once the new system was in operation I made regular visits to the firm to establish how it was working out. Apart from interviews with the Production Director, Production Manager, and Paint Shop Supervisors, I also carried out a follow up survey with the remaining paint sprayers. Again, I utilised the Hackman and Oldham survey , together with group discussions to discuss the results and its implications (see Appendix 6).

Although there were changes of both Production Director and Paint Shop Supervisor during the period, it proved possible for me to obtain an invaluable insight into the process of change involved on a before and after basis.

My role, therefore, in practice, became one of observation and as the firm were involved with the Polytechnic as a Teaching Company no real constraints were placed on me and the information I could obtain. As a result of this, I was able to follow the introduction through from early stages in the planning process, through

implementation and subsequent operation and evaluation. During the period of my involvement with Autonumis I also took the opportunity to make videos to be used for teaching purposes. This followed the introduction of the new system from its inception, through to its introduction and eventual operation. The data from this video and the transcripts of the interviews involved, also provided invaluable information and impressions for my research. In addition, I prepared a paper based on this application which was presented and published at an international conference on Organization and New Technology in Budapest in 1986. This paper forms the basis of the rest of the chapter.

The company origin

The company, employs approximately 130 people on the outskirts of Tetbury, a small market town in Gloucestershire, and although relatively autonomous were at the time part of a larger group. They manufacture a range of vending machines for cigarettes and rubber products, hot and cold drink machines to wine, milk and beer dispensers. The company, which has recently had a vigorous programme of new product development, has also been investing in new production technology including a computer controlled punch press machine and CNC press brakes.

Paint spraying

Paint spraying in this, as many comapnies, appeared to be a dirty and unhealthy job. The operators had to work in individual booths with considerable over spray which, without masks, presented a health hazard. Although the feeling in the shop was of camarade morale the physical conditions left must to be desired and in these conditions was an important notion for the change.

The robot project

With the current level of expansion of about 25% per annum, the company recognized that the capacity of the existing paint shop would become inadequate to maintain a supply of sprayed components and some change would be necessary. Following the feasibility study by British Leyland Technology, the company decided to opt for an automated system employing a robot and powder paint technology which, it was felt, would not only cope with the additional capacity

required, but through savings on direct labour, would improve profitability on the higher level of throughput. The potential benefits of the new system were seen to be:

1. Improved and consistent quality
2. Improved toughness and cosmetic appearance
3. Increased production capacity
4. Better labour utilization
5. Removal of unhealthy and unsocial task of manual spraying
6. The company would qualify for 30% DoI grant.

The development of the new system was undertaken by a firm of consultants who were experienced in robotics and were contracted to supervise the project from initial concept to the commissioning of the new plant. In conjunction with nominated suppliers for the robot, conveyors and spray booths the new system was planned and targeted installation was to be during the normal shut down in July 1984.

Changes in the system are illustrated in Figures 15 and 16, from which it can be seen that the new system involved departure from individual manual wet spray booths to an automated system employing power spraying technology. The new system was based on a conveyor which after degreasing passes components through two automated spray booths with oscillating spray nozzles. The robot automatically touches up corners that the oscillators could not reach and the components were then passed through the oven for final unloading and inspection. The speed of the line was fixed and the robot was controlled by programmes inserted in the computer control console. A certain amount of manual touching up was still required.

Considerable effort was put in by the company to plan the introduction of the new system in advance. Apart form the feasibility study staff were informed as much as two years in advance of the intentions. This has enabled the company to avoid any redundancies. A moratorium on external recruitment had been in operation for twelve months prior to the change.

While the then Production Director had some experience of these systems the company took the precaution of employing another firm of external consultants to act as a safeguard and to try to ensure that all aspects were anticipated and

planned for. In the event the new system was installed as planned and production commenced immediately after the shut down.

In economic terms, the project appeared to have been very successful. Quality, though of a slightly lower standard, had proved consistent, and the appearance of durability of the product were satisfactory, according to the production manager.

The increased capacity had been created and substantial savings on direct labour had been obtained. Operating costs of materials, energy and jigs increased, but these were, according to the company, more than outweighed by the labour savings.

A number of technical problems were experienced initially especially with the robot with problems of static, synchronisation with the track and on programming. However, these were overcome and as people gained experience, they were able to make more effective use of the robot.

Physical conditions still presented some problems in terms particularly of excessive heat and drifting powder spray. Perhaps, more importantly, the changes in the nature of the work and of sources of job satisfaction require closer examination.

Figure 15 Autonumis - Existing Paint Shop Facility

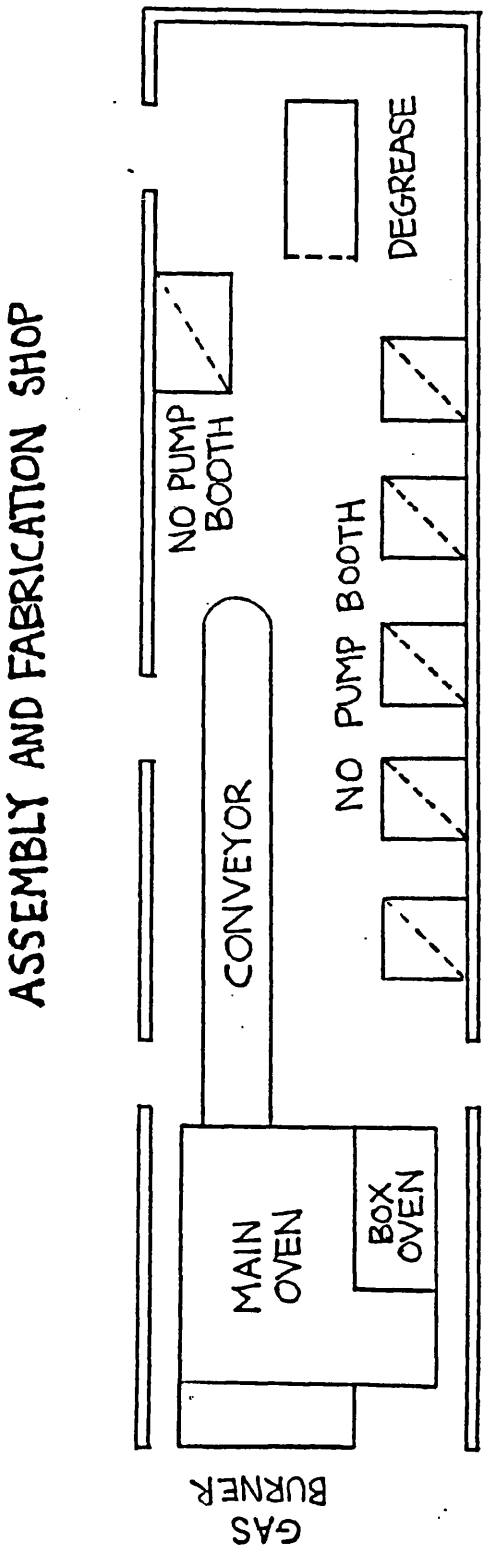
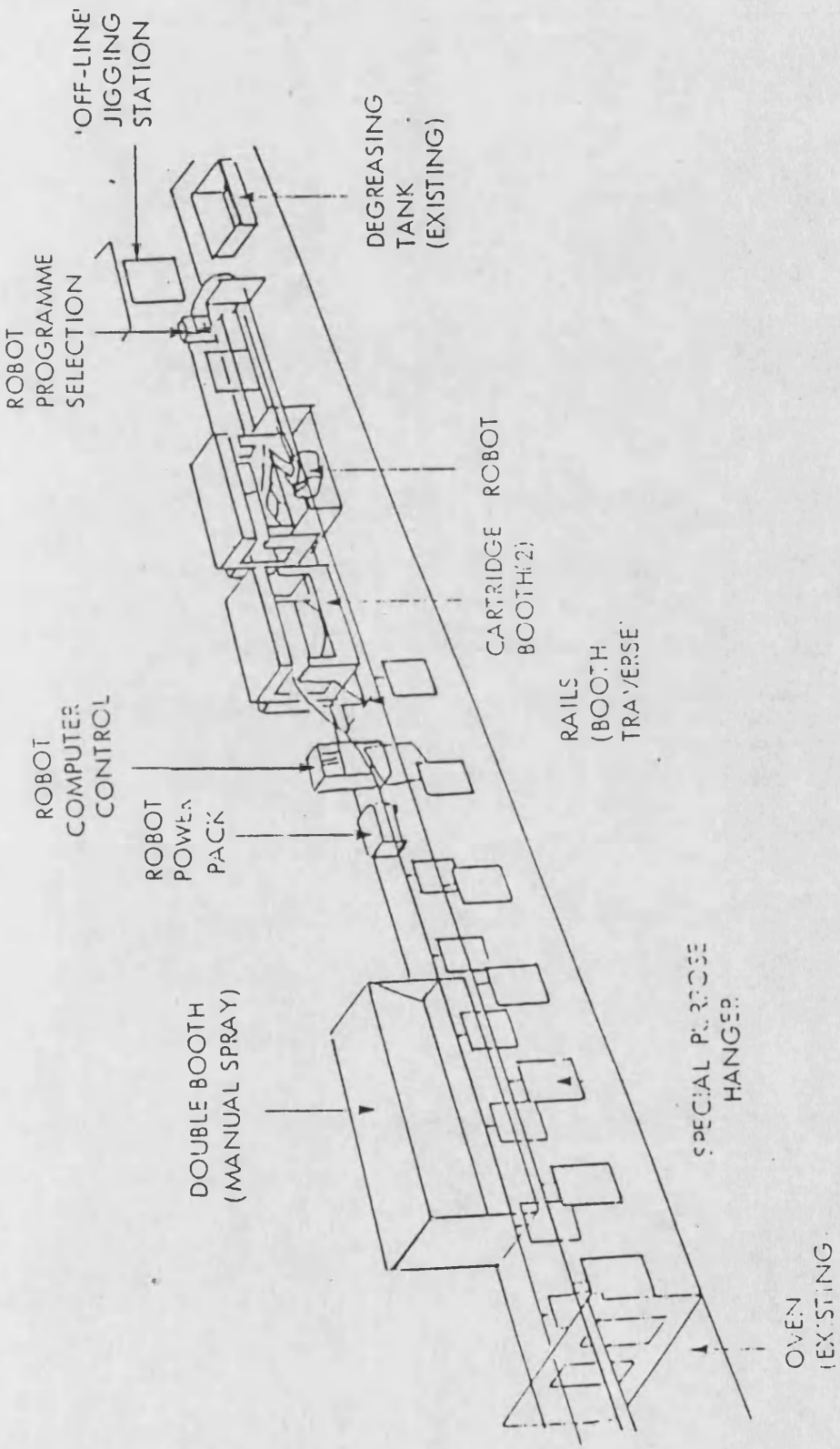


Figure 16 Proposed Robotic Spray Painting System



Changes in work organization

Manual system

The original manual system was based on the concept of one man one job and there was a coincidence between the **task** and **job** boundaries (see Figure 16 for socio-technical analysis of original manual system). Here, apart from the degreaser which was established as an independent job, the paint sprayers worked as individuals in an individual spray booth and operating with a fairly high degree of discretion performed a complete task with the exception of inspection which came under a different department. There was little if any need for interaction other than on a social plane and the role of the supervisor was concerned with work allocation scheduling and progress chasing.

Automated system

On the new automated system (see Figure 17) the inspection function had been incorporated into the department and it was generally felt that the automated system made consistency in quality standards easier to maintain. Maintenance was functionally separate, as in the manual system, although there was increasing evidence of involvement in production planning and maintenance issues (possibly against the production manager's policy).

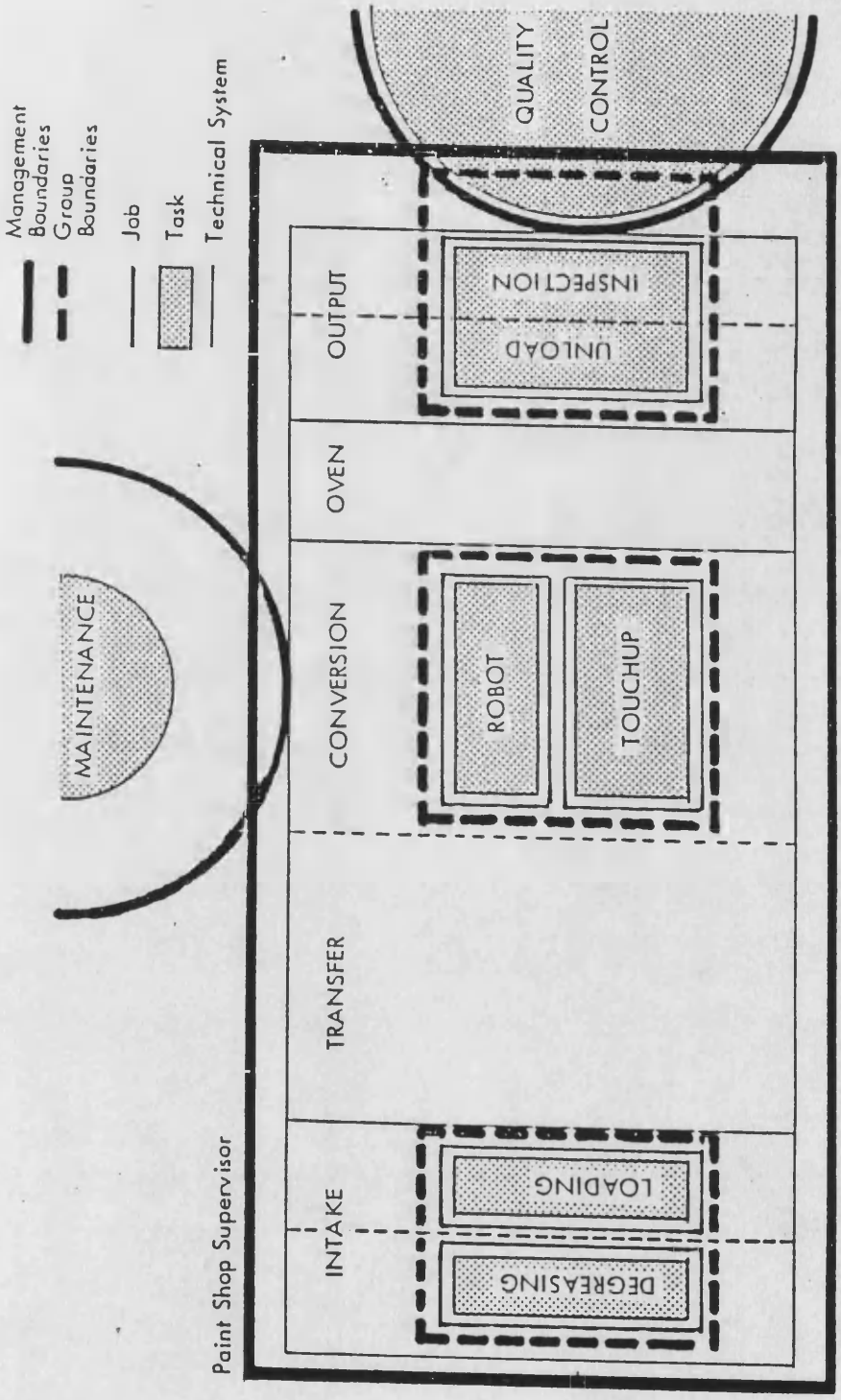
Task allocation

Despite the original policy of encouraging job rotation the operators were allowed by the previous supervisor to gravitate to particular jobs (possibly due at least in part to the fact that they had always had individual jobs before and felt more secure in this situation). Each job on the new system necessarily represented only a small part of the total task of spraying a component eg degreasing, loading, touching up, unloading and inspection.

Changes in job content and satisfaction

With the agreement of the Management Director, I carried out a survey to assess the attitudes of the paint sprayers to their jobs at the time and how they felt they might be affected by the new system. From this survey it appeared that while the operators

Figure 17 **Old System**



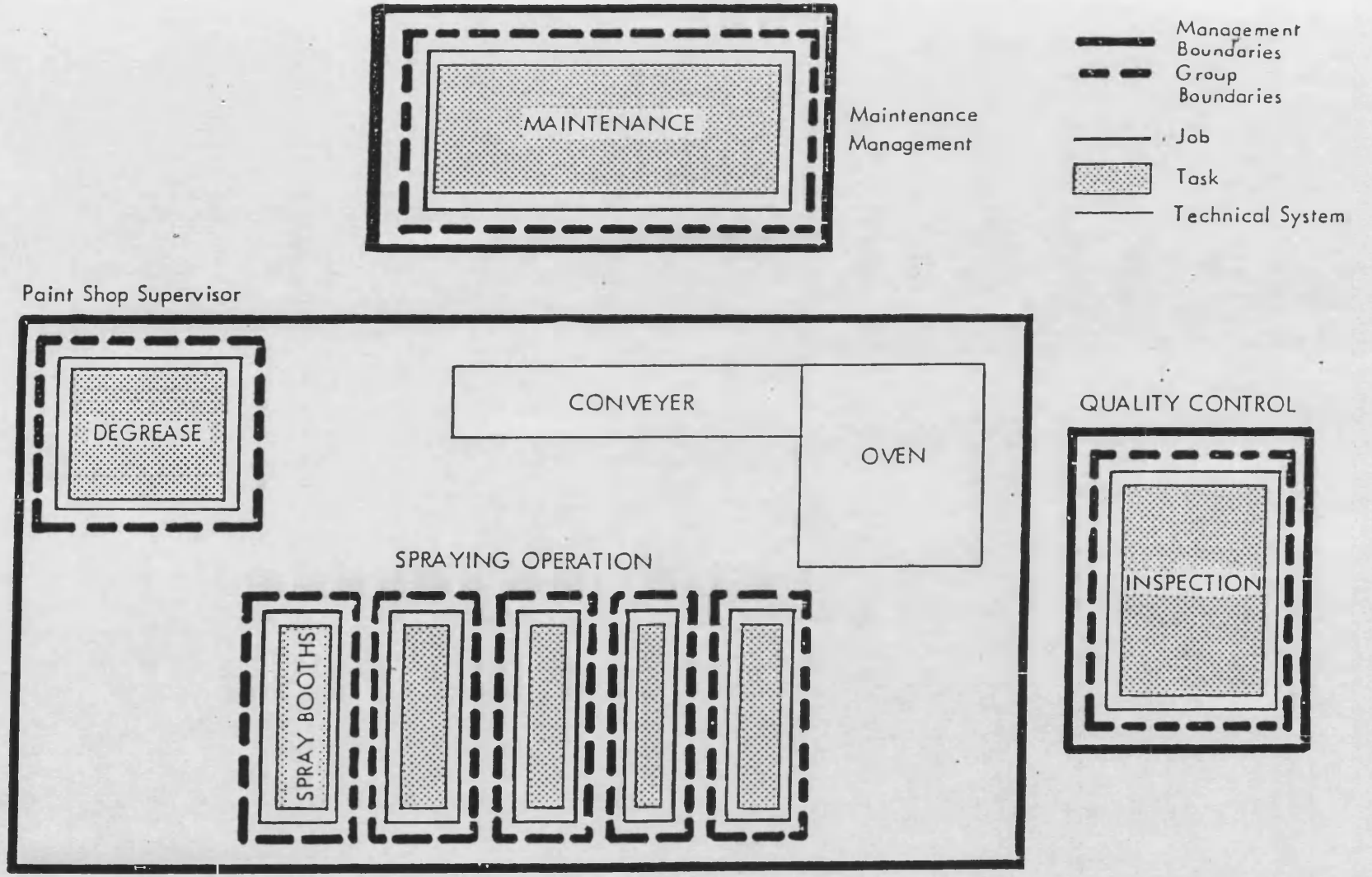


Figure 18 New System

would welcome the new system for the improvements in hygiene and working conditions that it would afford there was concern expressed at the potential loss in job satisfaction as a result of the robot and automation.

The survey showed that despite the working conditions people experienced a considerable degree of job satisfaction from their feeling that the job was important that they could exercise some degree of discretion as to how they did the job. Also they obtained direct feedback on the quality of their own work.

In the new situation they feared a loss of variety and demand for their skills. The job would be predetermined and they would not feel involved in the total task. Also in the new system they feared that they would not obt ain the feedback on quality that they experienced at the time.

Their preference, which coincided with management's own views, was that a system of job rotation would help to overcome some of these deficiencies and help to restore some of the variety and sense of the involvement in the total task that they had been accustomed to.

Installation of the new system

The new system was installed during the shut down and apart from initial problems in getting the robot working, production commenced early August 1984. At this stage, apart from some disillusionment with the robot, the operators co-operated with whatever was necessary to keep production going and a lot of hand spraying was required to compensate for the robot.

The consultants were for a quite long period absent from the scene and some difficulty was experienced in getting their assistance in getting the new system operating effectively. However, the Supervisor and the leading hand got involved in sorting out the programming problems themselves.

In the meantime, the staffing on the line had been reduced to four plus a leading hand and Supervisor as opposed to the 14 people previously employed (on a two

shift basis). A t this stage no group approach to work organization had emerged and job rotation had not been initiated, one person being 'stuck on unloading for 10 days at a stretch'. It was also proposed by the Production Manager that one person should be employed on inspection in order to monitor the standard required rather than everybody being involved in achieving the quality standard.

Effects on job content

While largely successful in economic and technical terms, there was a complete change in the nature of the task from a skilled paint spraying job to one of largely machine minding. This led to a marked deterioration in the quality of work experienced by people in the new system both for the operators and supervisor alike and resulted in a decline in morale.

Job rotation was limited mainly to touching up and the operators were confined to what some of them felt were 'mindlessly boring' jobs. Several people commented that they could not believe how slowly time was passing, and that when they thought it was lunch time it was still only 10.00 o'clock in the morning. They found the standing around very tiring on the legs and would all have preferred to be spraying manually despite the physical conditions. The operators themselves felt that the new system was no quicker and that the robot was not touching up properly.

These views were to a large extent echoed by the supervisor at the time who felt that the interest had gone out of the job. He resented the fact that he was denied involvement with maintenance and programming aspects of the new system which were for him a source of new interest and skills.

Although there were some individual variations in response eg from the person doing the tacking compared to the loading job, it was generally felt that the boredom was undesirable and that people's attention inevitably wanders with consequent dangers for safety and for the quality of work.

Changes to job characteristics

With the aid of the Hackman and Oldham questionnaire and subsequent discussions, I carried out a detailed analysis of the changes which showed some deterioration on all motivational characteristics of the paint sprayer's jobs (see Figure 19).

In terms of **variety** there was no choice of the components to be sprayed as this was determined by the computer. **Task Identity** decreased because they felt nobody was involved in the total task. **Discretion** also declined because whereas before people would determine their own pace of work this was now dictated by the speed of the track over which the operators had no control. Similarly, on the question of **feedback** whereas operators could previously derive feedback on the quality of their work they now felt it didn't matter.

Although the person working on degreasing felt he had some contact with other people, the other operators felt relatively isolated in their position on the line and satisfaction with the social aspects of the job had failed quite significantly.

Reaction to new system

Whereas people went into the change with an open mind, initial reactions to the new system were not very favourable. Some people expressed the view that it would be better if the line were totally automated as their jobs at present could be performed by 'monkeys'. It would certainly appear that in most cases the people employed on the new line were over qualified for the work that they are now doing which was essentially machine minding and would seek the earliest opportunity for transfer or alternative employment unless some changes were made.

Operator involvement

While on the basis of individual jobs involvement had clearly declined, there was some indication that this could be restored to a degree by the development of group or teamwork. At the point of changeover for example from one component or paint colour to another, operators could have some influence over the system (eg when Lofty managed to get the changeover down to 20 minutes, he said to David the

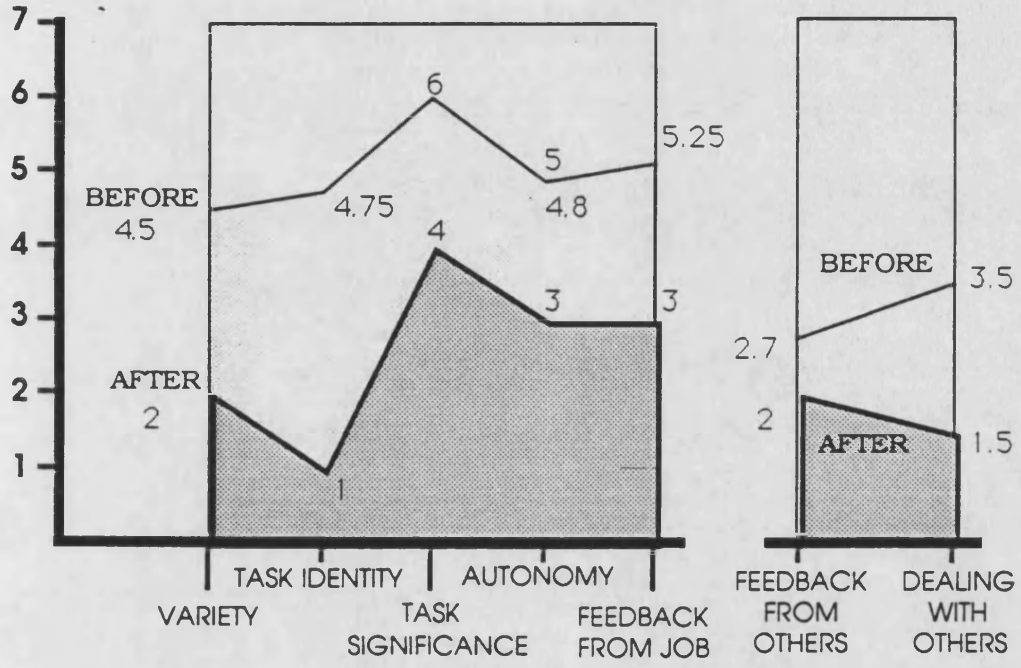
supervisor '*we showed em Big D*'. Clearly at this level there are many issues over which the group could have influence. They clearly had discretion to influence quality within the given limits of the quality standard and there is also evidence that they had some influence in the area of maintenance which could arguably become their responsibility to some extent.

Another important aspect was the involvement of the operators in lead teaching the robot in the production of new spraying programmes. In this way their skills are used and, to some extent, maintained and incorporated into the new system. Some 22 programmes have now been developed and sometimes as many as six attempts are required before a programme is perfected.

Arising from this point is the question of the maintenance of paint spraying skill on the section. To the extent that the quality of the programmes produced reflect the skill of the paint sprayers was important that these skills were maintained. To some extent this could be achieved by maintaining a manual facility primarily for touching up, but without the skilled paint sprayers it would be difficult to develop satisfactory programmes.

The previous supervisor decided to leave partly because of the dispute over his involvement in the programming and maintenance aspects of the new equipment. In the view of the newly appointed supervisor the new system called for teamwork. He stressed the fact that if one person does not do his job properly, eg loading, this affects others and the performance of the line. He argued that interaction was required between the operators on a problem solving basis and saw it as his role to develop this. There was increasing evidence of a positive desire on the part of the operators to become involved in the performance of the whole system and the supervisor intended to initiate fortnightly meetings to discuss progress and problems with the group. There is therefore some evidence of an 'incipient' group forming as a matter of necessity to cope with the nature of the new technical system which in many ways resembles a process plant in which group working is accepted practice.

Figure 19 **Changes to job characteristics/profile of paint sprayers as a result of automation**



n = 4 (for source data see Appendix 1 Table 2)

The role of the supervisor had changed considerable as a result of the change in the technology. Previously his job was very much involved with scheduling and allocating work and with problem solving and co-ordination within the boundary of the section. It also involved co-ordination between the jobs in the system as well as between his section and others in the factory, namely maintenance, quality and production planning. This left relatively little time for his man management role and communications as a result suffered.

With the new system the programming was done by the Production Manager and scheduling of the work was largely predetermined. The supervisor, therefore, had more time for communications and man management as well as for exercising his boundary management role. Here again the fact that responsibility for quality control was now incorporated into the department made him m ore autonomous and independent. He was now becoming more of a representative to management of the group's ideas and suggestions for improvements eg showers to overcome paint drift problems and improvements to the design of jigs. Even without the development of job rotation, the institution of regular group meetings and the creation of a teamwork climate will did much to enhance the operator's sense of involvement in the whole process. In fact, the supervisor was in favour of job rotation for example to help people identify more readily with the quality standard required although they were aware of what this was. Thus, the supervisor was increasingly taking on the role of social development in the new system.

Differentiation in the management task

Whereas there appears to have been a decisive move with the appointment of the new supervisor to a more employee centred approach in terms of management style, there is evidence of increased differentiation regarding the different aspects of management tasks in the paint shop.

Whereas previously the supervisor largely controlled the programming and scheduling the work in the shop, this control passed to the Production Manager who did not appear to have a great deal of direct contact with the paint shop or its problems. The supervisor retained and had developed his role in people management.

The Leading Hand, who was previously involved with inspection and direct supervision of the paint sprayers had now become the main specialist in the programming of the robot, control of the console and some aspects of maintenance of the equipment. This had provided him with increased job interest and had, in effect, given him control over the technical aspects of management in the paint shop.

Conflicting priorities

There is also some evidence of conflicts across the boundary between the paint shop and the rest of the factory in that the demands for changes in components and paint colours conflicted with the needs of the new system for relatively long runs. Constant changes were seen as disruptive by the paint shop supervisor but may on the other hand be vital in meeting changing customer needs. There was therefore some conflict between the requirements of the system for flexibility and for productivity. As already indicated this is a particular area in which the people on the systems can make a contribution to both aims by achieving more rapid changeover times, therefore minimising the losses to production.

Discussion

This case does demonstrate quite clearly the impact that new technology can have on the content of people's jobs. Here a responsible employer had taken considerable steps to ensure that no redundancies would occur as a result of automation. '*I personally am a great believer that automation doesn't reduce your labour force if you can plan it in the right manner.*' (Managing Director)

Equally, they took their responsibilities for communication and consultation seriously '*there weren't any secrets about what we were trying to do - that we were trying to reduce out commitment to manpower in that shop*'.

However, regarding work organization there is evidence of a lack of planning. Understandably, the company's initial concerns while planning the new system were the solution of technical problems and ensuring that the system was installed on time in order that production could be maintained. Thus the discussion in the planning group which was composed largely of component suppliers and technical

consultants plus company management and supervision concentrated on those issues. The planning meetings were dominated by the technical consultants and as one said '*All the subjects that have been discussed have been basically technical and any management problems they've got are internal*'.

It was felt that management problems would only arise if the unions were brought into the discussions, and it was generally felt that these were well within the competence of the firm to resolve internally. Some discussion took place on training, not for the operators, but for the supervisor and it was arranged for the supervisor and leading hand to attend a course on the robot. (In the event they attended the maintenance rather than the operating course due to an administrative error.) In view of this, the existing personnel have had to learn how to operate the equipment themselves and even now do not possess any manual or operating instructions.

At the planning stage, the issue of what form the structure of jobs on the new system should take was left open. The Production Director at the time felt it better to allow this to sort itself out once the system was running and that all hands might well be needed during the first stages of its operation.

Understandably primary concern was on the operation of the new system from a technical and production point of view'. While it was felt that some form of job rotation would be desirable the policy was adopted not to make any decisions on this until the new system was in operation '.

In the event, quite significant features and unanticipated consequences occurred on the social side of the new system. While it is questionable how many of them could have been anticipated, it is clear that a price was paid for the omission of the consideration of human factors at the early stages of planning.

In practice, once the new system was in operation, people gravitated to the jobs they knew or liked and as time went on, with the preoccupation of the supervisor with the technical problems of programming and working himself on the line to keep

production up, any such issues appeared to be overlooked making any changes now to work organization more difficult to introduce.

With a computer automated system and group technology, group forms of organization may be required if a satisfactory match between human and technological factors is to be obtained. However, this conflicts with the accepted concepts of work organization in the firm where up until now the norm of one man, one job and control by management and supervision have predominated.

The extent to which these problems can be overcome may to some extent be influenced by the approach adopted to the introduction of technological change ie the 'who, what, when and why' questions. For instance, the discussions on the paint spraying system were dominated by engineers who perhaps by training and to some extent by disposition are orientated towards technical and economic factors rather than human factors. This has implications for their training and/or the role of social sciences in the planning process.

As regards the issues discussed during the planning phase, ie the 'what' factors, it would appear that insufficient weight was given to the human factors, particularly relating to work organization for a satisfactory match between human and technological needs to be achieved. The policy of allowing it to sort itself out after the event does not seem to have worked very well.

To have achieved a satisfactory match it would seem important that these issues were given equal weight and considered at the earliest possible stage in the planning process. This would also have had the merit of allowing some adaptation of the technical system to fit the people. (For example, the opportunity for the operators to be involved in correcting the tapes was inhibited by the layout of the plant.) The question of why this did not happen will be taken up in the next chapter.

CHAPTER 8 - ANALYSIS OF DISCUSSION OF THE PAINT SPRAYING CASE

Introduction

This case study does provide some invaluable evidence regarding some of the key issues in the introduction of new technology and technological change. In particular, it highlights factors which may represent constraints in achieving a satisfactory match between the task and technology variables and those concerned with organization and people.

New technology and business strategy

One of the key issues brought out in this case is the potential conflict between the operational requirements for increased efficiency against the strategic need for greater flexibility.

The stated reasons and objectives for introducing the automated paint spraying plant were to do with increased capacity and productivity. With the expansion of the business, the company recognised the need for increased painting capacity. They recognised the opportunity that new technology provided to achieve this goal, while holding costs down through savings in direct labour.

However, the company was operating in quite a diverse market and had for some time had a relatively vigorous programme of new product development. Although a substantial part of their business involved producing drinks vending machines for General Foods there was a variety of other products and vending machines involving components that needed painting.

In the event the system proved to be very inflexible and the need for manual, off-line spraying had to be increased in order to cope with this demand. In fact the consultants in charge of the programme criticised the company for introducing new products and thus changing the specification of the system. This was despite a comment from the Production Director that "what we have here is a Flexible Manufacturing System!"

This demonstrates what can often be a problem with new technology in that it is often introduced for what may prove to be the wrong reasons. It is often sold and

bought by management as a way of increasing efficiency by reducing direct labour costs. Certainly this was encouraged in this case by the holding company's requirement of a two year payback period for capital investments which encourages a short term cost saving approach. Clearly, if savings are ultimately achieved this may help to make the company's products more price competitive. However, if as frequently occurs in todays market conditions, flexibility and speed of delivery are equally important criteria for success this needs to be reflected in the design of the manufacturing and delivery system.

As was demonstrated in the Normalair-Garrett case, it is possible to design a system that is both flexible and efficient, although this may have implications for the relative roles and disposition of the people and technology. It is therefore arguable in this case that had the company thought through the relationship of the new system to their strategic objectives, a different model and concept for the paint spraying process might have been devised. Such a system should have provided greater flexibility of response from both the technology and the people concerned.

Technological determinism

The second major issue raised by this case relates to the dominance of technology and technological considerations particularly during the planning process. In this instance, although the company stated that it was largely for '*insurance*' purposes, heavy reliance was placed on external technical consultants and contractors.

Interviews by myself and a colleague, with the consultants who were experienced in this type of application indicated that they considered this to be a relatively straight forward job. They also said that they considered that any manpower or trade union considerations were internal matters to be dealt with by management and were not their concern. Indeed, they expressed surprise that there had not been more resistance or problems with the shop floor over the impending introduction of the robot and new system.

I was able to sit in on some of the planning meetings and, despite intervening on such questions as training and work organization, found that the process was almost

entirely dominated by considerations of technical and task factors (see Figure 20). Questions on training and work organization were dismissed in a matter of moments and as none of the staff, with the exception of the supervisor, were involved, concern about these issues appeared to be secondary.

The apparent lack of concern or interest in these issues may have been reinforced by several factors:

- The engineering background and models of man held by the majority of people in the planning team; not only the contractors and consultants but also the members of the management team.

- The fact that in comparison to the technology and the unknowns involved, manpower and industrial issues were thought to be simple and relatively unproblematic.

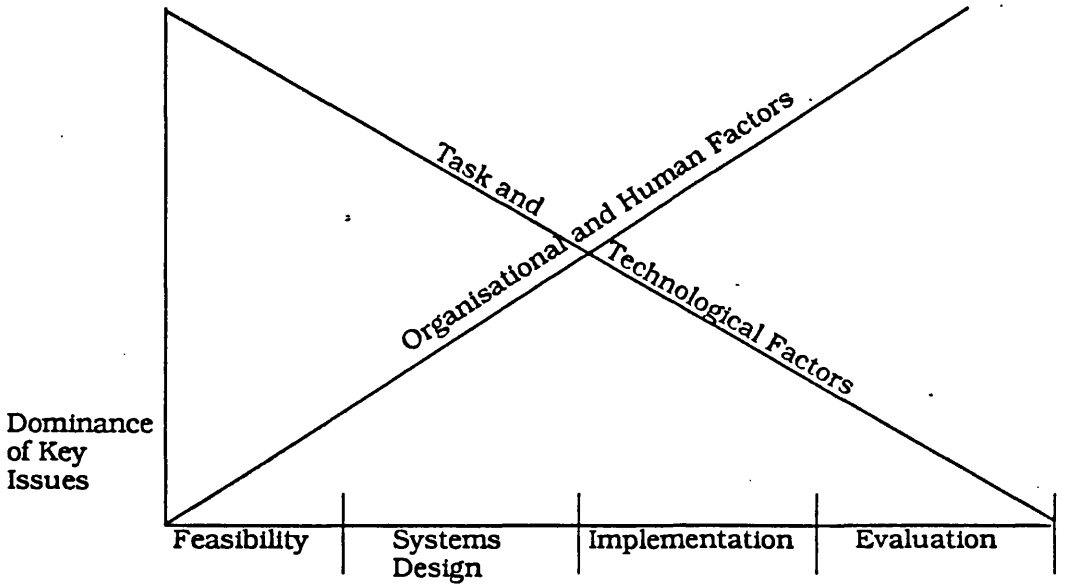
- The lack of a vigorous trade union organization and representation may have meant that management considered the workforce to be a relatively 'soft touch'. Their relative lack of knowledge and militancy meant that they did not make any particular demands and were likely to acquiesce to whatever solutions were proposed.

- The belief by management that they had done their job by the workforce in that they had communicated over a long period of time what their intentions were and in broad terms what the new system involved. In this they may, either by accident or design, have confused the needs of communication with those of consultation on a change of this magnitude.

Hence, the result of this technical domination in the planning process meant that issues such as job satisfaction and motivation, work organization, communication and supervision and management of the new system was given little consideration. The changes that might be required to the organizational and human variables were not recognized and this only came to light after the event rather than during the

planning phase. This feature and the dominance of technical consideration during the planning phase seems to be characteristic of many applications. As is illustrated in Figure 20, the human and organizational issues often only emerge after the event when it may be more difficult to make the necessary changes.

Figure 20 Phases in Planning Technological Changes



Impact of automation and job satisfaction

The question also arises from the case as to why people were so disillusioned with the new system and dissatisfied with their jobs. In this instance it proved possible to use before and after studies of people's reactions to the job characteristics using the Hackman and Oldham questionnaire and follow up discussions.

In the first instance management had made assumptions about the paint sprayers' attitudes to their jobs. This influenced their approach to the introduction of the new system, but was subsequently shown to be ill founded. Management assumed that the paint sprayers found the hand spraying job relatively undemanding and that they would welcome the new system for the improvements in hygiene and working conditions that it would afford. However, analysis of their reactions to the job of manual paint spraying showed that they derived a considerable amount of satisfaction from what they regarded as a manually skilled and responsible job.

Job Design theory would argue that for motivation and job satisfaction any individual or team should have

i. A clear and meaningful goal
ii. Discretion and responsibility to plan and organize their own work
iii. Direct and meaningful feedback on their achievement.

As individual paint sprayers these conditions were largely satisfied in that they knew clearly what they had to achieve in terms of performance and quality standard. They had discretion to choose in what order to spray the components and how to achieve the desired results, and from their own efforts and feedback and from the inspection function they knew whether they were achieving the desired results or not.

However, the automation of the process changed all this in that as individual operators, performing only one part of the total process, their sense of involvement in the whole task and more on task identity dropped dramatically from 4.8 to 2.2 on the Hackman and Oldham scale.

Similarly, regarding variety whereas previously they used a variety of skills and actions and worked on a variety of components, they were now confined (partly by their own choice) to a single, narrowly defined, repetitive task, eg putting on or taking off components from the track. Thus the score on variety had fallen from 4.2 to 2.1.

The scores on autonomy have also dropped significantly from 4.8 to 3.1 in that they no longer have any discretion about which jobs or components to work on and feedback fell from 5.3 to 2.8 because only the person at the end of the line sees the results and the final product.

Although the jobs previously were individual jobs the people were able to communicate and interact with one another with the supervisor, the inspector, and the degreaser. Now, with the physical distance between individual operators and the automated nature of the process their score for dealing with others has dropped

from 3.2 to 1.1. Add to this the fact that there were continuing problems with drifting paint, excessive heat and a robot that more often than not didn't work, the group and their supervisor experienced feelings of profound disillusionment and dissatisfaction. Whereas previously they had felt that they were doing an important and responsible job (as their score of 6 on Task Significance would signify) they now felt that they were just nobody's and that the robot now did the job. They were simply machine minders with no sense of responsibility or involvement at all. As one member said, "It would have been better to automate the system completely rather than create such 'monkey' type, mindless, boring jobs." A comment from the supervisor graphically illustrated the point when he said "people are now saying if you can piss, you can paint!

Alternative forms of work organization

Current knowledg e of alternative forms of work organization would suggest that there were options and alternatives, the relevance of which could and perhaps should have been considered in this situation. Recognized alternative and options would include:

i. Job Rotation
ii. Job Enlargement
iii. Job Involvement
iv. Group Working

Management were aware of the potential problems of boredom and monotony arising from the new system and 'were inclined towards a system of job rotation' to counteract this. In the event concern with technical and production problems meant that this was never adopted or encouraged. The operator gravitated to the jobs that suited them or they disliked least but were not of their own volition willing to initiate job rotation. In fact in their minds one job was as bad as the other and so they didn't really see the point. Had job rotation been encouraged and implemented it might have helped to increase people's Task Identity scores and sense of involvement in the whole task as well as improving their scores on Variety and Feedback.

Clearly, the concepts of job enlargement (horizontal integration of tasks) and job enrichment (vertical delegation and integration of responsibility and decision making) have relevance to this situation. However, they cannot be literally applied unless one person was to take responsibility for the whole process.

However, these approaches are relavant to the concept of group working which does provide for elements of job rotation, enlargement and enrichment. In practice, it could involve the group working as a team and taking responsibility for the overall operation of the paint spraying process. In this situation the group would operate more as a team in which each operator although they may have an individual task, identifies with the process as a whole and with the objectives that the team is working towards. These objectives each include targets in terms of delivery dates to customers, output and productivity targets, quality standards and the development of the process. In these circumstances the boundaries of individual tasks would become more blurred and job rotation would occur naturally as part of the overall task of getting the job done. Jobs would be enlarged in the sense that people would feel that they were involved in the whole process rather than on one initial task. Job enrichment could occur in that individuals, as part of the team, could become involved in the planning and organizational decisions required. Closer liaison and involvement with functions such as production control, quality and maintenance would also enrich the jobs and help to track down the traditional barriers that exist between these functions.

Were such an alternative to be adopted, the scores of the operators on such factors as variety, task identity and significance, autonomy and feedback would arguably be very much higher as would those in feedback and dealing with others.

Social structure of organizations

However, perhaps the most important question arising from this case is why when knowledge and information on job design and work organization was available it was not used? Why was so little attention given to the people and organizational variables and why was the available expertise not used?

Some clues have already been given to the answers to the question in the dominance of engineering, in the education, training and experience of the management and planning teams. Valuable though this is, it can create a problem when dealing with what is a multi-disciplinary type problem or development. The problem would equally arise if for example it was dominated by accountants who, while they might have a good command of the financial aspects of the change, might have difficulty in appreciating some of the technical and human considerations.

However, the dominance of engineering models and concepts of man and organization are likely to condition and influence the approach adopted in the design of the new system. Engineers are arguably likely to view an organization more as an 'mechanism' than as an 'organism', a 'closed' rather than an 'open' system. Thus people will have to fit round the technology into predetermined slots and perform precise functions rather like the mechanics of a clock. The only problem with a clock is that it has to be wound to make it go and thus supervision is required to direct, organization, motivate and control the workforce.

It may be more difficult for people with limited awareness in the social sciences to recognize the nature or existence of the informal organization, identified as long ago as in the Hawthorne studies. In this sense the organization can be viewed as an 'organism' whose performance and survival depends as much on the interaction between people in the system and between it, and its boundaries as on the performance of individual tasks. In this situation individuals take much more responsibility for their own motivation and management, the boundaries of jobs and between jobs are less rigidly defined.

These analogies apply very directly to the paint spraying case where management approach to organization design in the first instance was one of a scientific management, utilising the 'concept of a closed mechanistic system'. However experience and the problems arising from its operation increasingly suggested that a different model employing a more 'open organismic system' concept would be more appropriate.

These observations were borne out by an analysis of system boundaries in the change from the manual to the automated system. Whereas in the manual system (see Figure17) there was a coincidence between the task and job boundaries in the sense that each individual paint sprayer had the information, discretion and control to perform his function, the same cannot be said for the individual operators in the automated system (see Figure 18). The task of paint spraying is performed by the system as a whole, while individual operators are performing such activities and putting on and taking off components from the track. It is only by involvement at the level of the overall task that there is a coincidence of job and task boundaries. Only if each individual operator was a member of a team who are able to plan, organize and control their work and the overall process would there be a coincidence of the job and task boundaries.

Role of supervision in an automated system

Discussion on possible alternatives in terms of work organization inevitably raises the question of the role of supervision in such a system.

In this particular case the existing supervisor in the manual system performed a traditional supervisory role scheduling and allocating work and dealing with problems across the boundary, particularly with quality, inspection and with maintenance.

Clearly, if a group form of organization were adopted many of the decisions and functions would be performed by the group themselves thus raising the question of whether there is a role for a supervisor in the conventional sense in an automated system such as this.

The company clearly had not recognized the change that might arise in this area because shortly after the new system had been operating the existing supervisor left. He had been initially enthusiastic about the new system but once it was operating became bored and disinterested. He tried to create interest by becoming more involved in the technical and maintenance aspects but was then disciplined for this by management who did not consider it as his job and this undoubtedly contributed to his departure.

Without any question as to the need or the opportunities that this might create, the company replaced him with a new supervisor who, by disposition, was more employee centred in his approach. As was discussed earlier in the case, the supervisor himself recognized the greater interdependence of jobs on the plant and encouraged a move towards greater team work and involvement. This, however, happened very much by accident rather than design and his good intentions suffered in the prevailing climate of production and output within the firm. For example, it had been his intention to hold regular meetings of the group to help develop team work but this had not proved possible in the event and it did not appear to have been encouraged.

However, these experiences do provide clues as to the changes that may be required as a result of automation particularly if this is accompanied by moves towards group and team working.

The supervisor in these circumstances in the conventional sense is redundant. What may be required is more of a team leader whose role involves the development of team work. Thus, he may help the group in clarifying their objectives and evaluating their own performance. He may provide them with training in such functions as communication, interpersonal skills and problem solving and encourage them to act as a sort of quality circle. While initially, this may be quite a full-time job increasingly as the group's competence and confidence develops, he or she will need to pull back to give the group the freedom of operation they need to manage themselves and their activity.

Management attitudes and values

However, the question still remains as to why when information and expertise was available these problems and needs for change to the social structure of the organization were not recognised or predicted. If these factors were recognised why was nothing done about them?

One possible explanation could be lack of knowledge. However the Managing Director, who was responsible for overseeing the project, was himself an ex DMS student who had attended a one week workshop on job design and work organization. So, although

he was not involved in all the detail he could certainly have influenced the overall approach to the design of the system and its introduction.

A further explanation could have been lack of available information or expertise. However, as part of the Teaching Company scheme the firm had access to the Polytechnic staff and as co-ordinator of the scheme my own knowledge and contacts were available to them. In addition they had a full-time Teaching Company Associate resident at the firm who was aware through tutorial of the needs and opportunities in this direction.

With such resources at their disposal one must conclude that there were other factors which accounted for the approach which was adopted which relate to the relative roles of management and employees and to the management's need for control.

Conventional management theory would emphasise their need to direct, organise, motivate and control the work force. This approach is particularly prevalent in the traditional parts of the engineering industry and may often be more readily accepted in a rural environment when traditions of 'master and servant' die hard. However, there was also evidence that employees in rural areas were willing to accept more responsibility if management were prepared to give it (Turner and Lawrence, 1965).

However, changes of the type discussed earlier involving work group autonomy and the removal of direct supervision could fly in the face of strongly held notions of the proper roles of management and work people.

Technology should if anything increase management ability to control the production process and minimise disruption by the human element. Therefore if anything the introduction of new technology should enable management to reduce its dependence on the human factor and either eliminate or reduce their influence on the production process. This notion fits with the conflict model of management where the means of production are seen as a potential source of profit and labour as an unfortunate but necessary cost. Therefore, anything that can help to reduce the latter and their dependence on people, will be welcomed by management.

This strategy however is based on the assumptions by management that the only thing these people really want from their work is money and that therefore they will do as little for as much as possible in return. However, evidence from research and from the paint sprayers own reaction to their jobs was that they appreciated and responded to responsibility and involvement. Thus, given the right conditions they are capable of self motivation, management and innovation and rather than just being a cost are capable of generating profit through improved performance, productivity, problem solving and development. Such concepts and assumptions however call for a very different approach to management and organization than the conventional model and imply a very different approach to the introduction of new technology. A summary of these implications is included in the following chapter.

Organizational culture

Observation and analysis of this case study does appear to reinforce the relevance of the prevailing culture of the organization to the role and introduction of new technology.

Rightly or wrongly, this small but quite successful company does have a relatively conventional and traditional approach to the management and organization of its work force. The style of management though varying from one individual to another overall is benevolent but autocratic and paternalistic. Trade Unions though recognised are not particularly well organized or militant and the level of membership is quite low. In this context while management might see the need to communicate, they would not feel any obligation to consult with either the trade unions or the shop floor. Consistent with this overall style is the notion that management are the primary sources of information and expertise and only with reluctance would admit their need for any external information or advise.

Planning is seen as very much a management function and prerogative and therefore the idea of involvement of the people doing the job in the planning of change does not fit with these assumptions.

Similarly, the functions of work organization, motivation and control are very much the 'raison d'etre' of middle management and it would be very foreign in such a culture

for these functions to be delegated to the people doing the job. Indeed, as the attitudes of the paint sprayers themselves revealed they are quite accustomed to accepting managements right to make the decisions, even if in the event they don't like the results. They have not had the opportunity or the training for a wider involvement and would be inclined to the view that its management's job to manage and that's what they are paid to do.

In many senses therefore one might argue whether or not the approach to the introduction of new technology, the design solutions and ultimate outcomes were not inevitable and even appropriate to the situation that applied? If this was the prevailing culture would an alternative approach have stood a chance of succeeding anyway? The changes and alternatives discussed for the organization of the paint spraying department are in such contrast to the prevailing culture and climate of the firm that even if they had been accepted the chance of their long term survival could arguably have been rather slim.

Of the alternatives involved, job rotation, which had clearly been suggested , was the most likely one to have been accepted as this does not require any changes in the organization structure or in responsibilities and decision making. In other words it does not 'rock the boat' and while its benefits may be limited at least it might have been acceptable in the prevailing climate.

Nevertheless, the price of making change in such a culture is that people may suffer at the expense of technology. Frequently they will suffer in terms of employment and job security but equally they may suffer in terms of job satisfaction, human involvement and the quality of their working life. Such outcomes, apart from being socially undesirable, do have their costs in economic terms. The effects on attitudes, motivation, attendance to detail, stress, health and safety, and the effective utilization of human skills and enterprise is likely to be very negative. Whether such a solution and outcome is effective in today's competitive markets and business environment is, to say the least, questionable. Many people would argue that we can ill afford to employ people in such jobs in which we make so little demand of people's potential contribution.

The final question therefore that this case study poses, is whether this situation is inevitable and what possibilities exist for changing the prevailing culture?

Much of the problem seems to arise from treating the introduction of new technology as a specific change in one specific variable in the organization, namely in terms of technology. If management recognises the need to keep all the key variables in the organization under regular review and accepts the need for change as a continuing function of business survival and organizational effectiveness, then the adoption of new technology will be put in its proper perspective, ie it is just one aspect of the continuing changes required for effectiveness in today's business environment.

While we cannot expect technology to change the world , the scale and scope of the changes involved does provide the opportunity for some fundamental questions to be asked. It can, as discussed in the earlier cases in Part II, provide an opportunity to unfreeze existing attitudes not only amongst management but amongst the workforce as well.

If we add to this the need for the organization to be open to information, experience and knowledge from outside then they may be encouraged to explore and experiment with alternative approaches and to learn from the process.

Unfortunately, the Teaching Company schemes in which this firm participated was funded by the Science and Engineering Research Council and thus the expectations of all concerned were for technical change and development. Since this time the SERC and Economic and Social Science Research Council have combined and also become involved with the Teaching Company scheme and although joint funding of projects is still the exception rather than the rule more mutual influence will hopefully take place.

However, while there might have been problems in bringing about a change in culture in this specific situation, evidence from the case studies in Part IV provides illustrations and encouragement of what it is possible to achieve.

CHAPTER 9 - COMPUTERIZATION OF AN ORDER OFFICE
Impact on Jobs in Ushers Brewery

The fourth case study: origins and involvement

From the outset of the research I had been anxious to include office applications of new technology as much as manufacturing applications. My opportunity to study the computerization of an order came as a result of my previous involvement with Ushers, the brewery, as a consultant on employee involvement.

The company, at the time, 1979, had been concerned about the impact of the Bullock report which advocated employee and trade union representation on the boards of companies. Much of the British industry reacted at the time, including Watney Mann and Truman Group of which Ushers were a part. As a result of an article I wrote following a European study tour of work organization, I was contacted by the company to help them try to develop employee involvement at the level of their jobs and my expertise in job design and work organization was considered relevant.

Following a management survey into their interpretation of employee involvement a working party was established from which a number of initiatives and changes stemmed. In particular, problems had become apparent with the distribution function which proved to be inefficient and costly. Also people felt that the draymen lacked motivation and that there was a big divide between them and the staff in the order office and load planning.

As a result of consultation with trade and trade union representatives it was agreed to restructure the organization into smaller teams of draymen, load planners and operators, each serving regular customers in geographical areas called 'zones'.

My role was more a catalyst than as a prescriptive consultant helping the organization to define its goals and measure where it stood in relation to these. Informally in the planning meetings, options and alternatives were discussed to obtaining greater involvement but it was up to the individual departmental managers to determine their new strategy.

Following the change in the distribution organization, I was able to conduct a thorough evaluation of change which proved that it had been very successful. Considerable improvements were achieved in customer service, cost reduction, job satisfaction, teamwork and industrial relations (Bailey 1983). The Distribution Manager won the National Distribution Manager Award for the year in question, 1979, this was well publicised within the company and was felt would serve as encouragement to other functions to place their own changes.

Following this, when I was no longer employed by the company as a consultant, I took groups of students to see the distribution function as an example of what could be achieved. It was on one of these visits that I learnt of the company's intention to computerize the system. I expressed interest in this development and sought the opportunity to be involved. However, although not asked for my professional advice, I was able to negotiate an opportunity to review the changes particularly regarding their effects on the job of the staff concerned.

Data collection

From my previous involvement with the company it was not difficult for me to arrange for interviews and data collection on the system and its effects. In fact people were only to ready to talk to me about them. This study started in the summer of 1985.

In the first instance, I interviewed the new Distribution Manager to obtain background about the changes and what the company were trying to achieve. I also interviewed the Manager in charge of Transport and Warehousing and the newly appointed Telesales Supervisor to get more details of the system and their approach adopted to its introduction.

I spent some time with the telesales girls and the load planner familiarising myself with the new system and its operation.

I already had, from my previous work, data from the Hackman and Oldham survey on the manual system. I was able to obtain comparative data by issuing the survey to the five telesales staff. Following this I held interviews with the staff to discuss their

eactions to the new system and the effects on their job satisfaction. Apart from this I was also able to have informal discussions with the Manager and Telesales Supervisor off-site and with the telesales staff over a Christmas meal. These occasions provided invaluable opportunity to obtain informal feedback about the new organization and the system involved.

I summarised the results of my findings in the form of a report and working paper which I sent to the Distribution Director (see Appendix 7). I hoped that this would prove helpful to the company and might also stimulate some thought as to possible alternatives. This working paper forms the basis of the case which follows.

The new office system

The new system, based on a Data General MV 4000, provides the operator with the following functions:

1. Order taking - the details of customers' orders are entered onto keyboard
2. Load planning - the operators' records delivery note number and enters it on programme
3. Delivery confirmation - confirmation of exact deliveries made on corrected delivery note
4. Post delivery order entry - key orders back in
5. Stock recording - records changes in stock levels on continuing basis.

Each telesales operator had their own VDU screen and al list of customers with basic data about address and telephone number. Three operators were also provided with the customer order history for the last five weeks, thus enabling them to check the customer's current level of stocks and what additional potential orders they may require. Orders when received, were immediately keyed into the system and printed out on a delivery note in load planning.

The system was developed centrally at the Brick Lane Head Office as a package to be used throughout the Group. There was little, if any, adaption of the system to suit local circumstances and as the customer manager said, "*we had to make the*

package work for us". Experience showed that there was a number of facilities that would have been helpful at the local level, but all of the development work was done at the head office and there were no facilities for providing a local input in the system design.

Reorganization of the department

At about the same time the new Distribution Manager felt the need to rationalise the distribution department in order to counteract rising costs and offer a more efficient delivery service.

As with computerization, the aim of the rationalization of the distribution department was to reduce costs while maintaining the level of service to the customer.

The concept of zones was abandoned on the grounds that it led to inflexibility of labour and unequal work load between zones.

Depots cost money in terms of wages and stocks and the nine depots in the region were reduced to four which, it was felt, would ease stock control. Now articulated lorries have to serve the three regional depots.

The number of Draymen was reduced from 64 to 41, eliminating the third man and employing a larger vehicle with a capacity of nine tons.

Originally, there were four load planners, one to each zone. They have now been reduced from four to one, the latter being in control of the whole area, thus it was felt improving flexibility.

As regards the telesales operators, the previous structure meant that they each dealt with any of a number of promotions or types of sales activity. This, it was felt, led to inefficiency and people making mistakes. Now the full-time telesales staff have been replaced by part-timers who, by working in the morning are able to get all the orders in before lunch. This helps the load planners by making all the afternoon available to plan the following day's deliveries.

A working party was set up for the reorganization at Trowbridge and since then Saturday morning problem solving sessions have been introduced wit the Draymen. Distribution Management felt that the involvement of people in target setting, decision making and feedback on achievement and how well they have done has paid off.

Installation of new system

Initially, people lacked confidence in the equipment. Down time could be anything from five minutes to five hours and this tended to undermine morale and confidence. However, training sessions on the new equipment of about 2 or 3 hours were set up alongside manual operations. Discussions took place on progress and problems with the intention of keeping a relaxed atmosphere.

Discussions took place with the staff about the changes required. One of the load planners was transferred to be checker and another left the company, but only after training had been given to her on VDU operation to help her get another job.

Once the new system was installed, new job descriptions were created raising the jobs from Staff Grade 2 to 3. Although a number of new staff were appointed, the higher grade compensated to some extent for reduced hours involved in going from full-time top part-time work.

The two systems were operated side by side for 7 weeks during which time specialized training was provided by the Head Office staff in operating the new system, eg cancelling and amending orders.

Evening sessions were held each week to de-bug the system. Managers would phone in orders presenting the girls with types of problems anticipated. Then the operators were put for a whole day into an existing live system within the group and this helped overcome nervousness about the first day' operation of the new system.

The system was eventually launched on 29th March 1984, with champagne and buffet lunch, to mark the degree of involvement of everyone from the Managing Director to the Draymen in the introduction of the new system.

Full-time staff, who were unable to accept the change to part-time employment, were offered training and assistance to find alternative full-time work.

Role of supervisor

The appointment of a telesales supervisor was intended to shield the girls from problems and queries which might interfere with the basic task of order taking. Whereas previously the girls handled their own problems and queries these were now referred to the supervisor. Problems such as complaints on delivery and queries on paper work are dealt with by the supervisor who adopts the policy that 'the buck stops here'.

Another key role played by the supervisor was in terms of training. Product training was being organized to keep staff up to date with special promotions and a monthly training session was held in the evenings to iron out problems.

Performance results

1. Costs

Considerable savings were achieved in terms of reduced costs, by reducing the number of depots from nine to four, the number of draymen from 64 to 41 and the number of vehicles, as a result of introducing larger vehicles.

2. Customer service

Customer service with the zoning system was very high, approaching 100% deliveries on the next day.

Job satisfaction and involvement

Although I obtained data from the staff both before and after the change, in the elapsed period some members of the group had changed. Therefore one cannot be sure that observed differences were entirely due to the changes in the jobs.

However analysis of the two sets of Hackman and Oldham data indicates that while the general level of satisfaction of the telesales staff with their jobs was quite high,

there were quite significant differences in the key characteristics of their jobs under the new system from those under the zoning system. In analysing this, one must allow for the fact that the new incumbents were part-time as opposed to full-time employees and that this possibly leads to different expectations of their work. Generally, they felt satisfied with their jobs because they fitted in easily with school hours and home commitments and the level of pay is high.

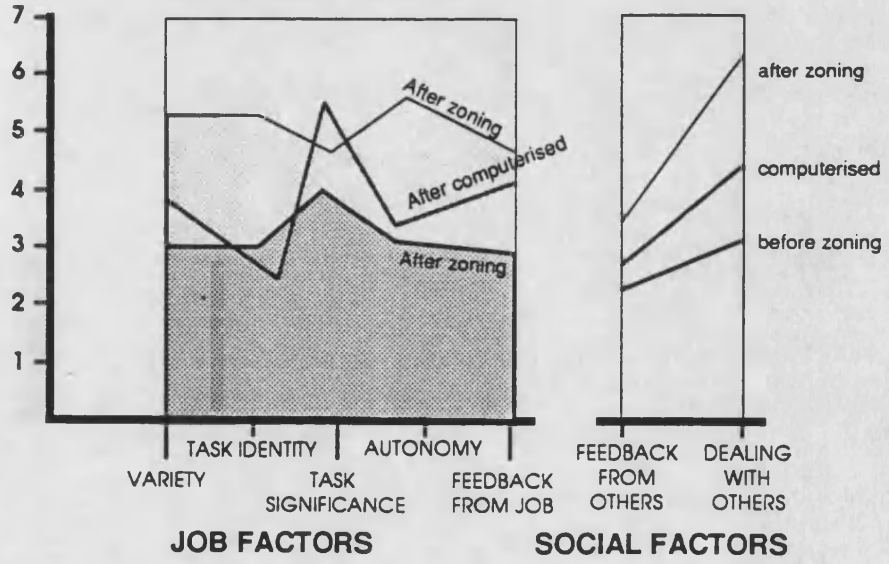
Variety

As can be seen from Figure 21 **variety** decreased considerably in comparison to the zoning system, where the telesales girls could, for example, be involved in load planning. While the introduction of products and promotions has increased their feeling of variety over the original structure, there was a decline in this aspect of the job.

Task identity

Of more significance, however, is people's assessment of **task identity** which declined from 5.5 to 2.3. Previously, staff involved in this function felt involved in the total delivery tasks, whereas now they performed only one part of it, albeit a very important part in their eyes, as the score on task significance indicates.

Figure 21 Characteristics of telephone sales operators' jobs as a result of changes in organisation and computerisation



N = 7 (for more data see Appendix 9, table 3)

Autonomy

The other factor which declined is **autonomy** where the increased involvement of the supervisor with complaints and problem solving, and the fact that calls they had to make were predetermined, left the girls little discretion in how they did their work.

Feedback

With introduction of zoning, **feedback** from the customer to telesales was vastly improved because of the direct contact with their own set of customers. Under the new system, although they don't deal with any particular customers, they still rated this factor quite highly, although they didn't know what happens to a load after it leaves and they didn't see the delivery confirmation.

Social factors

As can be seen from Figure 21 there was some deterioration of feedback from others, ie colleagues and/or supervisors and also on dealing with others, either clients or colleagues. How much of this is due to the introduction of the computer as such, or to the change in work organization is questionable. Certainly the girls felt that they got less feedback on their own performance from the supervisor in the new situation than before. As they were working individually there was also less opportunity for feedback from colleagues on telesales or load planning.

Similarly, while they rated their customer contact through the telephone quite highly, the relative lack of contact with load planning and the draymen led to a decline in their assessment of dealing with others.

Summary of effects on job content

Although the assumption could be made that, as part-timers with relatively good pay and convenient hours, job satisfaction for the telesales staff was not important. Evidence from the survey would not support this assumption. The general level of expectation of interest and satisfaction was quite high. The results of the survey showed an average measure of 5.2 on a 1-7 point scale, measuring the growth needs of the staff. This meant that a number of people found the work rather tedious and monotonous and this they felt did effect their motivation to the job.

Clearly, the major questions raised by the case are the effect on the organization of work, whether or not other alternatives or options could have been adopted at the time the system was introduced. What changes might currently be possible to improve the characteristics of the jobs, and how far the existing technical system inhibited any changes in work organization or job design.

Copies of a version of this paper were made available to the company and the Distribution Director at the time. Although I was unable to obtain any formal response or comments from the company to the issues and questions posed, informally, concern was expressed by middle management and employees over the changes that had occurred. These basically centred around the loss of communication and contact between the staff involved, namely telesales, load planners and the draymen, and between the staff and customers. There was a strong feeling that what had been achieved in terms of reduced costs was at the expense of staff motivation and involvement and of service to the customer. It was felt that there had been a major shift within the firm towards a policy of 'hard sell' and cost reduction. The opinion was that although staff had no option but to go along with this, they didn't really believe in it.

CHAPTER 10 - DISCUSSION OF THE DISTRIBUTION CASE STUDY

The relationship that I built up with the Company from the work described earlier has enabled me to maintain a continuing contact. I have been able to take groups of students to visit the site and study the changes and effects on a continuing basis. It has thus been possible to monitor the changes in attitudes and approach by management and staff alike over a period of 10 years.

Harmonisation and integration

One of the most interesting questions in the introduction of new technology is whether the issues raised and potential solutions apply equally to white collar/office situations as they do to manufacturing and the shop floor. Further, how far such divisions have any logic or make any sense in today's computerized settings.

In the previous reorganization the draymen had been brought much closer to the office staff by creating small integrated teams who were involved in the whole delivery process. This not only helped to reduce costs and improve the delivery service, but it helped to remove the us and them situation and the divide between the office and the yard.

The introduction of computerized systems of management and information can potentially do much to integrate previously separate functions by providing a common database. Thus, there was the opportunity and potential here to further integrate and enhance team work to the benefit of both customers and the staff.

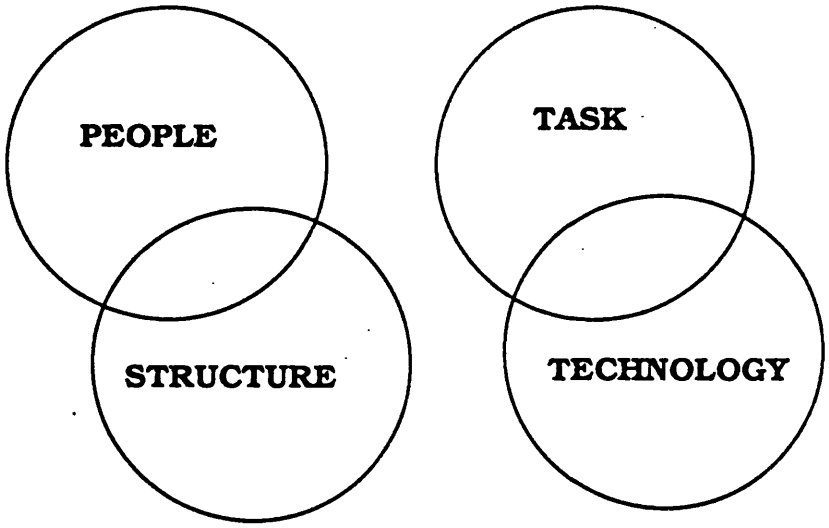
However, the approach adopted was one of 'scientific management' in that the separate functions of telesales, local planning and delivery was emphasised. In the original zoning structure it was recognized that the task was the 'delivery' of the beers that this depended on co-operation and teamwork between those that received the orders, those that planned the loads and those that delivered the beers. Thus, the task boundary was around 'those needed to work together to get the customer the produce and service they required'. The teams that had been crated to such good effect were broken up (a la Durham Coal Mines) to met the perceived needs of increased efficiency and to fit the design of the new computer system.

Human contact and interaction was largely replaced by technology and the computer to the potential detriment of relationships not only between members of staff, but also potentially with the customer.

Changes in business environment and managerial strategy

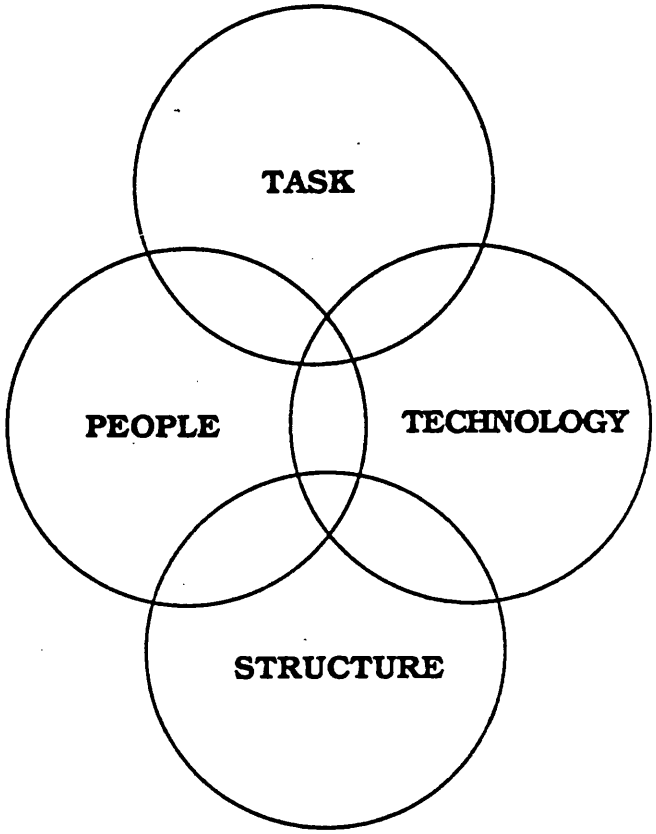
This case study graphically illustrates two alternative strategies to improving organizational effectiveness on the one hand through people and, on the other, through technology. It demonstrates the advantages and benefits from each, but it also illustrates the limitations of over dependence on either strategy. In what was a self-evident and classic illustration of a socio-technical systems, the strategy swung dramatically from a social to a technical solution of the problem. (see Figure 22).

Figure 22 Alternative Models of Systems Design



In the one case, emphasis on people, flexibility, teamwork, involvement and communication was seen as the best strategy, while in the other, emphasis was on specialization of tasks, technology and managerial control. As suggested in Figure 23, socio-technical system theory would suggest that the more effective strategy is a design solution integrates both people and technology in the achievement of the task.

Figure 23 Total Systems Design and Integration



The social solution

The original change to the zoning structure in 1979 took place in a climate of increasing emphasis on employee participation. Indeed the overall culture within Watney Mann & Truman Brewers nationally was one of employee involvement, promoted by the then chairman, Alan Sheppard, of British Leyland. This helped to provide an umbrella within which the involvement project for which I was the consultant was initiated.

Following a survey at management level their definition of Employee Involvement was defined as:

- greater job satisfaction and team work leading to a better service to the customer and increased profitability.

Thus, with the overall objectives established individual managers and functions were encouraged to evaluate their situation and their own departments against this. A management working party was formed and many changes took place.

However, in particular there had been criticism of the performance of distribution and the manager concerned responded to the challenge by initiating a major reorganization of the distribution function to better achieve these objectives.

His approach to the problem was highly participative, involving consultation with representatives of both customers and staff. The Trade Representatives who came after the Draymen were brought in at the outset and involved in the analysis of the problem.

However, they were also able to identify a model which they would hope to replicate in any solution that was developed. In this instance the problems experienced in the larger department at Trowbridge contrasted with the smaller rural depots where motivation, team work and customer service seemed to be very effective. This use of a model (a concept of the situation that ideally should apply) appears to be very useful in helping people develop a solution in practice.

Following these discussions as the case study describes agreement was reached to restructure the distribution organization around the concept of smaller autonomous units, similar to the rural depots in which the function of telesales, load planning and delivery were combined into closely integrated teams. This combined with the ability to serve a regular set of customers, led to quite dramatic improvements in motivation, teamwork, efficiency, customer service and industrial relations.

My own role enabled me to follow up the results of the change, and to conduct a thorough evaluation. However, in addition to this the project which was quite widely publicised was selected as the winning entry to the annual National Distribution Management competition and the distribution manager won the award. However, it is indicative of his style and approach that he took the Trade Representatives with him to receive the award, because he argued that their success was as much a result of their efforts as of his.

Thus, referring to Figure 23, the strategy adopted, ie a people centred participative approach profoundly influenced the design solutions and the resultant organizational structure and management style. It placed an emphasis on the notion of employee involvement motivation, delegation, autonomy and team work and placed a high premium on the need for good communications and relationships. In short, it was a classic human relations approach with all the emphasis on the social side of socio-technical systems equation.

The technical solution

However, technology in the zoning system was very basic, involving manual records and customer plates with customer records and delivery information. These had to be manually maintained and up-dated and were no doubt by today's standards very inefficient. Also, as described in the case, whereas the late 70s was a period of growth and experience, the early 80s saw a decline in economic activity and stabilisation of beer sales although costs and competition continued to increase.

The business environment in which the firm was operating therefore changed and this was reflected in a change of climate and of management within distribution. A new director and distribution manager was appointed with experience of new, more efficient distribution systems. These systems which involved trunkers with detachable trailers and containers meant that the firm could dramatically reduce the number of depots by holding stock locally overnight to be picked up for local deliveries in the morning. Similarly, changes to the manning levels of drays were negotiated from three man to two man crews which achieved further savings.

At the same time, with the competition to retain market share, there was increasing emphasis on sales rather than marketing or customer service and in the role of telephone selling in achieving orders. This coincided with the development centrally of a new computerized sales order processing system which was intended to provide more efficient backup and information systems to enhance telesales and delivery performance. The system as the case study describes also provided information for load planning and for confirmation of deliveries.

Thus, as can be seen, there was a quite dramatic change in the climate in which distribution management, were operating and in their interpretation of what were the criteria for effectiveness and for survival in a very competitive environment.

Perhaps, rightly, the strategy employed was one of rationalization, consolidation and automation all with the primary aim of reducing costs and increasing sales. Service, though important, was not though to be the predominant factors for success and the effects of the changed strategy was reflected throughout the reorganization that took place.

In the first instance the SOPs system which was developed centrally was orientated around the role of the telesales operator. As was described in the case study, it is designed in order to help them increase their customer calling rate and to provide a better technique in terms of customer information. In this respect it is very effective in that information on customer past orders enabled the operator to be much more sensitive to likely customer needs.

However, the system was clearly designed with certain assumptions about the role of the staff associated with the system, their relation with one another and on the management structures concerned. The telesales operators were now confined to a predetermined and repetitive sales and order taking function with little if any involvement with the other aspects of the delivery tasks. Their discretion and involvement in solving problems has been removed in that a telesales supervisor has been appointed who takes over any queries or problems that need to be resolved. Their links with potential customers have been severed and they now specialise in the promotion of particular products. The implication of this is that it was felt to be more important that they were familiar with particular products than with particular customers as in the past.

Similarly, the links with load planning and the draymen have been broken in that the load planner is now physically separate and some distance from the telesales office and the draymen do not relate to any particular telesales operator. The zone structure as already indicated was abandoned in the interests of greater flexibility and utilization of resources.

Thus the structure and approach to management and organization in distribution as a result of these changes was therefore very much one of 'scientific management' employing specialization of function and hierarchical control. Motivation is largely by financial incentives and co-ordination is provided by management. Technology is employed to help increase output and productivity, communication is primarily by telecommunications and the data provided by the computer.

Clearly, in the design of the computer system little account had been taken of the existing social structures at Trowbridge and of the significance of the zone organization. If these factors were considered it would appear that it was based on the assumptions of separate functions and, for example, no provision was made in the design of the system for information of deliveries to be provided for the telesales girls. Thus, one of the most important job design criteria, namely feedback, was not catered for and this could have important implications for their motivation to achieve the sales required.

Similarly, the load planner who now performed an individual task was very isolated in a separate office, having relatively little contact with anybody other than via the computer. As a consequence, not surprisingly, is motivation and morale were rock bottom.

Rightly or wrongly therefore, the case also demonstrates the impact of the technical solution on structure and style of management adopted (see Figure 24). As it indicates human considerations of factors such as motivation, teamwork relationships and communications did not receive much consideration. The structure and style of management was based on achieving increased efficiency through specialisation, co-ordination and control which was reinforced by the computer technology. The resultant jobs were specialised and repetitive with little human contact and much of the satisfaction, involvement and teamwork previously established was lost. Staff tended to view their jobs as purely instrumental, looking to incentives, attributed to particular promotions as a means of motivation and reward.

Alternative solutions and forms of work organization

The issues and questions that this case study raises are in many senses very similar to those relating to the Robot Paint Spraying case. How far was the approach adopted the only possible solution and what alternatives could have applied? Were the results in terms of people's involvement and satisfaction inevitable, or could a better match between people and technology have been found? Were the benefits in terms of increased efficiency at the possible expense of customer service and the longer term image and relationship of the firm with its customers? How far, for example, in a service function such as this is it important to maintain the involvement and commitment of the staff.

Prior to the zoning project, there were many complaints about the level of customer service from the firm. Indeed it was quoted that if on a Friday night a publican rang the order office to find out what had happened to his beer, the impression given was that the girls neither knew nor cared. There is a danger that in the new system, where all the emphasis is on sales and orders and the computer makes no provision for confirmation of delivery of the order, that if staff are not motivated and responsible that a similar situation could arise again.

In a function such as this, successful completion of the TASK, namely supplying the customer with beer, is dependent not just on telesales, but also on the other people within distribution and their ability to work together to get the customer his beer. In this sense, therefore, the computer system should clearly have been designed to support not only the individuals in accomplishing their job, but also the team in successfully fulfilling the TASK. Thus, arguably the system could have been designed to provide the team with the data it needs to do the job, namely in sales, load planning and delivery information to all the members of the team and the provision of an efficient and prompt sales and delivery service. Opportunities for extra sales and for easing deliveries can be identified and problems solved. The Draymen themselves can help to identify sales opportunities and how route and load planning can be improved and the telesales girls can often help to get the customer the beer he needs more quickly through their knowledge of the delivery situation.

Involvement of the staff in this type of problem solving and performance improvement could avoid the necessity and cost of a telesales supervisor and could do much to enhance the motivation, satisfaction and a sense of responsibility of the telesales girls and other members of the team.

In this situation the teams would all share the same objectives in terms of sales, costs and delivery performance, and all would receive direct and meaningful feedback on their performance against their objectives. The team, however, would have a high level of autonomy to plan and organize their work and the delivery of the beer. The computer system would enhance the provision of information to the team and feedback on the key variables concerned.

In these circumstances the scores on such factors as variety, task identity, autonomy and feedback would be much higher as would those for feedback from others and team work.

The problem here is that the computer system was developed without recognition of the existing organization structures and without any real consultation with either local management or staff. The system was developed by the computer department in London and little account seems to have been taken of the local and human factors involved.

While savings in terms of costs and increased efficiency were undoubtedly achieved, the l onger term effects on customer relations and customer service are more difficult to estimate. At the time the new system was introduced, the company stated that the 'customers have not suffered'. However, customer relationships are at least in part a function of the attitudes and motivation of the staff and their willingness to help and serve the customer. If, as a result of rationalisation and technological change, people's satisfaction and sense of involvement suffer, this may ultimately effect their attitudes to their jobs and to the customers. In a competitive climate, unless they are a 'tied property' the customer has the freedom to take their business elsewhere.

CHAPTER 11

INTERIM REFLECTIONS ON KEY FACTORS INFLUENCING INTRODUCTION OF NEW TECHNOLOGY

Review of Stage III of Research

While my objective at this next stage of my field work was to see how job design concepts could be used in the introduction of new technology, the results of my investigation were to reveal why they are not.In both cases the companies concerned were aware of my interest in job design and through me had access to job design information and expertise. However, despite being offered these facilities, their priorities and concerns were in different directions. Neither company seemed to me to have learned from their previous experience of these issues and occupation with economic and technical issues seemed to virtually rule out human and social considerations.

Thus, while in both cases I believe that alternative forms of management and work organization could have improved the fit between human and technical needs, the opportunity to achieve this was not taken. My analysis of the reasons for this suggest that this was not due to lack of knowledge or that the alternatives were not feasible. The reasons seemed to me to be to do with the assumptions held by management about the relative roles of people and technology and what they thought would be effective in the situation concerned.

Whereas the two cases in the first stage of my field work served as something of a revelation of what was possible, the two cases in the next stage of my field work showed what was not. They represented something of a watershed in the development of my own thinking and helped me to recognise the importance of such factors as strategy and culture in influencing the role of new technology and the use of job design in its introduction.

In terms of strategy the cases demonstrated to me that if management see their objectives largely in terms of achieving cost reduction through new technology, this will have inevitable consequences on the role and contribution of people in the

process. In these circumstances, as the two case studies highlighted, job satisfaction and employee involvement is likely to suffer. While this may be undesirable from a human point of view, the question also arises as to whether in today's circumstances these are the right objectives to pursue. At a time when other criteria such as quality, customer services and corporate image are also important factors in achieving business success, a strategy which minimised the people and their involvement may be questionable. Certainly there was some evidence to suggest that the companies concerned had not adequately thought out the relationship between technology and business strategy and that this had far reaching effects on the solution adopted.

However the two cases also demonstrated to me the significance of the prevailing culture both in influencing management's interpretation of their strategy and the means by which this can be achieved. In both cases it appeared that the culture and climate of the organization was dominated largely by economic and technical considerations and a belief that it was management's job to manage. In these circumstances technology will again be seen as a means of minimising the human contribution and enabling management to exert more effective control over people and the performance of the system. Even if job design concepts and alternative forms of work organization were theoretically possible and could result in a better match between people's needs and those of the organization and the technology, I realised that these would be unacceptable with the culture that prevailed.

At the end of the third stage of my research I summarised what I now felt were some of the key factors and issues that related to the introduction of new technology and these formed a framework for my investigation during the final phase of this research. The key factors which I identified at this stage were as follows:

Corporate strategy

In both cases in my view there was a demonstrable need for the company to relate the introduction of new technology to the strategic objectives and development of the firm. There is a danger of sub-optimisation of goal in seeking cost savings through the introduction of new technology which may run counter to other longer term objectives of such as the quality of service to the customer. Clarification of the strategic

objectives of the business and the contribution that new technology can make to their achievement will obviously greatly influence the way it is introduced and the ultimate role played by technology.

Company philosophy

In this sense it is helpful for management to be conscious and aware of its own philosophy and the values and principles it stands for. Thus, although there is a need for organizations to adapt and change in response to the environment, the fact that they believe in and stand by the concepts of customer service, quality, involvement of people and for example the Pursuit of Excellence can help to guide all those involved in and with the business and in the introduction of any change. In the cases concerned there was some evidence that these issues may have not been fully thought through and that company policy was being blown by the wind! One of the advantages of a manual system, whether t be in the office or on the shop floor, is that it is infinitely flexible. Once one has made the investment in the technology and its particular disposition it is much more difficult to change. In this sense the systems and solutions that are developed for today may not be appropriate for the circumstances required of tomorrow.

Technological determinism

In both cases the system was developed largely from a technical perspective with very little input or influence from the user and the people who would ultimately be involved. As a consequence the requirements of the technology dictated the requirements of the social structure rather than the reverse and people had to fit and adapt to the system.

This appears to be largely due to the composition and backgrounds of those involved in the planning and design process of the development of technical systems and the fact that technological consideration dominates the process. In this sense, the problem is that only in one of the key variables the needs and opportunity for change in TECHNOLOGY is being considered. If there was recognition of the need to review

the role and interdependence of all the key variables against the objectives the organization was trying to achieve then different design solutions might emerge.

Models of management and organization

The cases also demonstrate that in many instances people are still working with conventional models and notions of management and organization when introducing new technology. Assumptions about the role of management to provide direction and control, and of traditional structures involving specialization and centralization of control, profoundly influence the design of the social structures when introducing these new systems. Yet the scope and scale of technological change may provide the opportunity and need for new models and forms of management and organization if full benefit from the technology and the people concerned is to be obtained.

People and technology

The approach adopted in both these cases implies certain assumptions about the relative role of people and technology. The implication is that people are less dependable and valuable than the technology which by contrast is predictable and controllable. The implied assumptions are that people view their work as instrumental; a necessity in order to earn the money they require to live. However, research and evidence from both these cases reveals that people are often looking for much more from their work and the chance to take responsibility and be involved.

Therefore, rather than diminishing the human contribution, as was done in both these cases, new systems should perhaps be designed in such a way as to enhance the contribution that people can make to improve output, productivity, quality, customer service and profit. Perhaps we should view people not just as a cost but like technology as an investment in improved performance, profit and innovation. If so this will clearly influence the relative roles of people and technology in the design of these new systems.

Design of jobs and work organization

In both cases there is evidence of a lack of awareness or concern about the quality of the work that will result from these new systems and the contribution that job design and alternative forms of work organization could make in these situations. Despite exposure of the organizations concerned to information, expertise and advice in these respects was not used for one reason or another. Yet analysis of both cases demonstrates that job design and alternative forms of work organization could have helped achieve a more satisfactory match between the needs of the people concerned and the organizations and that this may well have helped increase the benefits from the new systems and the service provided to customers concerned.

Bridging the gap

Analysis of both cases shows the opportunities that new technology can create for bridging the gaps and divisions that have hampered organizations in the past. The opportunity exists for white and blue collar workers to work together and co-operate under the same physical and employment conditions. The computerized systems can also help to break down functional barriers and to give the people doing the job more involvement in the specialised functions designed to support their activities.

Finally, the opportunity exists to close gaps between management and work people by removing supervision and by involving the workforce in the management process In neither case were these opportunities taken, but subsequent analysis of them shows the potential for change that new technology can create.

Organization and management for new technology

At this stage of the research I developed these ideas in the form of a working paper which I produced as an outcome of my research at this stage, which I intended to submit to an international conference at Eindhoven in Holland, on Advanced Manufacturing Systems.

In the event, I was unable to get the money to go, but I believe the paper represents a significant stage and outcome of my research and reflects the development of my thinking at that time.

Although the examples are related, in the main, to the manufacturing situation, I believe that many of the issues and principles that emerge apply equally to the office setting.

ORGANIZATION AND MANAGEMENT

FOR NEW TECHNOLOGY

A paper prepared for an international conference on Advanced Manufacturing Systems in Eindhoven, 1987

ORGANIZATION AND MANAGEMENT FOR NEW TECHNOLOGY

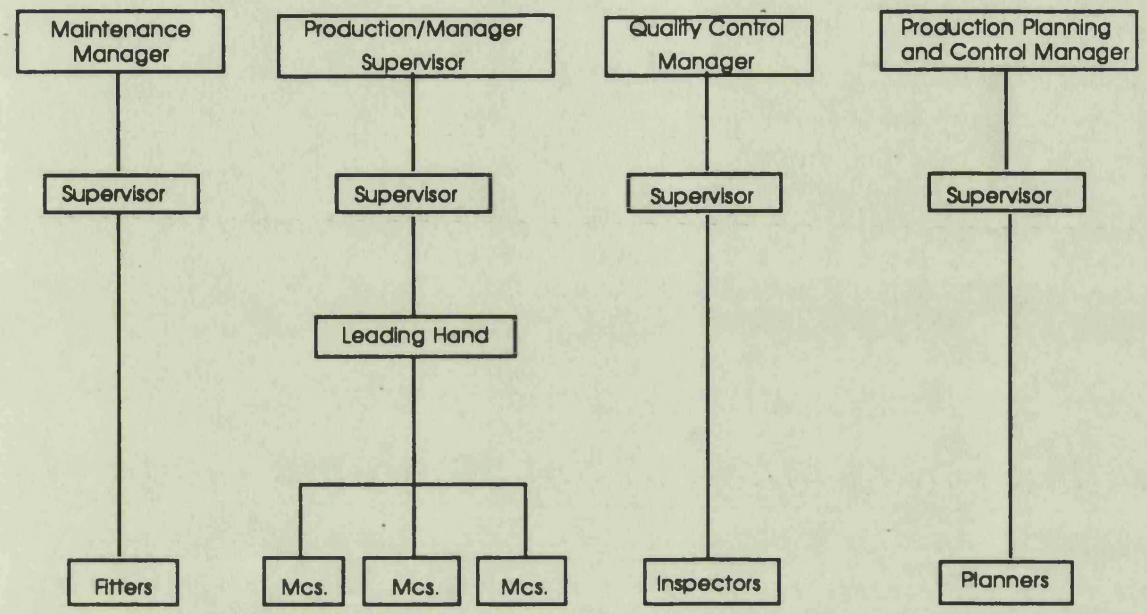
Innovations in new technology have brought far reaching changes to the technical design of office and manufacturing systems. Does new technology and computer aided systems of automation create a requirement for social innovations in terms of new models of management and organization?

Changing environment of manufacturing

Traditional structures based on specialization of task and hierarchical management and decision making may be increasingly inappropriate to these new systems and the changing external environments in which they operate.

In the past, the market need has been for relatively long runs of standardised production, where the key factor has been high output at low cost. To meet this prescribed and predictable requirement, a 'mechanistic' type of production system capitalising on economies of scale and utilising the principles of specialization to increase efficiency and output, may have been appropriate. Specialization in terms of tasks e.g. machinists, inspectors, maintenance personnel and planners, it was argued, helped people become proficient in these activities and increased the efficiency of the line. Similarly, in terms of decision making, decisions would be made at different levels in the hierarchy from leading hand, supervisor to management, or superintendent level and by different functions e.g. planning, quality control and engineering maintenance. (see Figure 24)

Figure 24 **Traditional production organization based on specialization of functions and decision making**



However, in today's circumstances, the market increasingly requires not only low cost, but also choice and flexibility in terms of design, quality and speed of delivery. In a market where the consumer has a far greater range of products and services to choose from, the supplier must be far more customer orientated and be prepared to adapt his product and production schedules to meet the customer need, while still keeping his costs down.

Computer based automation

It is here that the relevance and logic of computer based systems of automation and information becomes apparent. It is their ability to rapidly re-programme the schedules and outputs of any system, at low cost, to meet rapidly changing needs that is their 'raison d'etre'.

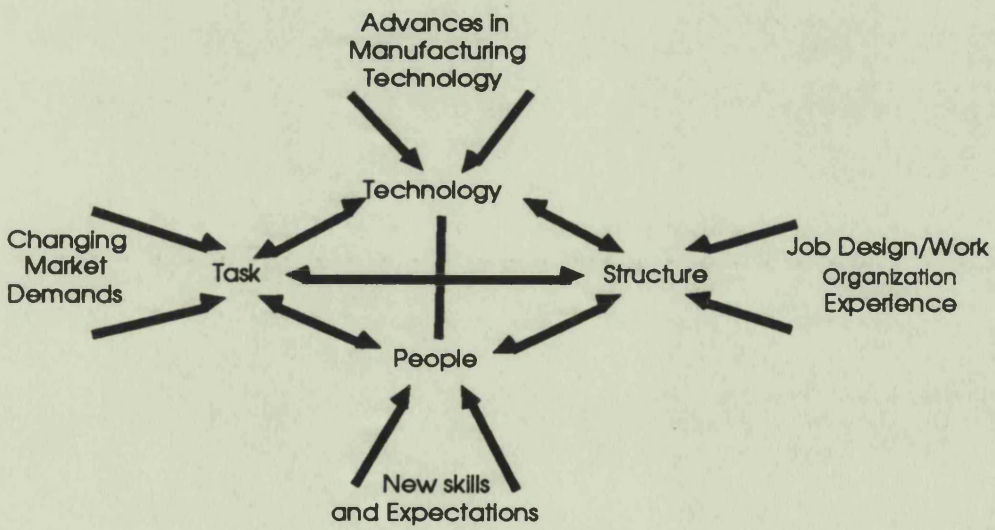
Such systems where properly conceived, rather than resembling the mechanistic structure of a traditional assembly line, more closely resemble a process plant such as is found in the chemical, drink or food processing industries. In these industries there has been a greater recognition of the changes to the work and skill content of jobs associated with these plants and the requirement for a delegated and decentralised style and structure of management at the operational level.

Implications for organization

The newer, flexible, computer automated systems of manufacture call for different concepts of organization to be applied to ensure an effective match between the people, the technology and the other variables concerned.

As can be seen in Figure 25 changes in the **TASK** (i.e. response of production system to market environment) and changes in **TECHNOLOGY** (i.e. technical system for creating product/service response) will require corresponding changes to **STRUCTURE** (i.e. roles and relationships) and from the **PEOPLE** (i.e. in terms of knowledge, skills and attitudes required).

Figure 25 Changing factors in manufacturing technology



In the current decade, as opposed to the 60's and early 70's, the major forces for changes are affecting the **TASK** variable from the market, in terms of competition and **TECHNOLOGY**, as a result of innovations in micro electronic design. These processes increasingly demand a response in terms of the other two variables namely **PEOPLE** on the one hand and **STRUCTURE** on the other. However, these changes in **TECHNOLOGY** represent something of a 'stepped' change and as a result have potentially significant destabilising effects on the other variables. Thus, potentially, as a result of planned technological change, existing attitudes and assumptions as to the role and contribution of **PEOPLE** and the **STRUCTURES** of work and relationships required may become unfrozen. Both management and the workforce may perceive the need for, or be receptive to, new concepts of work and organization in the new systems.

Participation and attitude change

From this we can see the relevance and logic of the participation of those likely to be involved in, or affected by, the introduction of the New Technology, since it is by exposure to the new systems and their implications that existing attitudes and assumptions will be challenged and potentially new solutions determined.

Organization design

But what concepts and models of organization are appropriate to the new technologies and how should they be designed or evolved. Great effort and energy is expended on designing the technical system involved, but how, in what is in effect a Socio/Technical system, should the corresponding social system be designed and developed.

i. Group forms of organization

In the traditional organization jobs are conceived as independent functions, with any necessary co-ordination being provided by management. In an automated system, jobs tend to be more obviously interdependent since, if one person fails to perform his task properly by loading at the beginning of the process or inspecting at the end, the overall operation of the process and the product will suffer. Similarly, since the jobs are interdependent, it is important for people to appreciate how their work affects

others at different stages of the process. For these reasons it would appear more appropriate to conceive of the workforce as a group, who are all involved in the total task rather than simply performing specialised parts of it.

ii. **Programming of machines/changing of balance of mental/physical skills**

One of the main impacts of computer based automation in manufacture is to remove the manual skill content of the majority of jobs. The mental decisions made by the craftsmen or operators regarding, for example, speed of feed and depth of cut, are now entered into the computer programme enabling the computer rather than the operators to operate the machine.

The traditional approach of specialization would be to appoint programmers who specialise in this particular task, but this can create communication difficulties between the programmers and those operating the machines. A more effective solution is to give the operators themselves the responsibility of programming and to provide the necessary training to enable them to do this. In this way their skill is retained and the computer becomes an extension and expression of their abilities. Also it can be seen as an advantage that the computer can take over the repetitive physical tasks.

iii. **Management of the system**

The fact that the computer takes over much of the original manual work clearly means that fewer people need be employed on an equivalent production system. But it also raises the question of the role of management and supervision in such systems. In the traditional structure, management task is concerned with planning, organization, co-ordination and control in what was normally a relatively stable environment or assumed to be one. However, in today's circumstances, the system has to respond much more rapidly to changing demands and in this situation a hierarchical management structure, with the communication problems that this causes, is less appropriate. Apart from these reasons the hierarchical structure tends to prohibit the involvement of the workforce for themselves in the decisions affecting them and their work. This, apart from having a demotivational effect, means that their potential contribution to problem solving and creativity, in relation to the manufacturing process, is lost.

Thus, from both operational and behavioural points of view, there are strong arguments for the greater involvement of the workforce themselves in the operational management of the new system. As a work group they are close to the process, its problems and its performance. Since they are a work group, recognising the interdependence of their function there is less requirement for co-ordination than in the old production system. With the aid of the computer and VDU terminals it is possible for the operators themselves to get direct feedback on their work and the performance of the system, together with data on other factors such as stock levels of component, or materials that may be required in the production process. This means that the work group, in possession of the necessary data, are themselves in a position to exercise control over their own operation rather than being dependent on supervision.

iv. **Flexibility**

Similarly, when it comes to the organization of work, in a traditional system the scope and perspective of an operator was confined to his individual specialised task and thus it was essential for a supervisor to make the decision relating to the allocation of tasks and organisation of work. In the new system, where flexibility is often the key factor, a more delegated approach may be required, where the operators as a group, with knowledge of both the total task and their own skills, can allocate tasks and make decisions about work organisztion more readily themselves.

Planning can of course take place on several levels from the overall production programme to the more detailed scheduling of components to achieve the plan. While the decisions of '**what**' has to be made are clearly determined elsewhere by the production and sales managers, '**how**' the plan is to be achieved is another question. At this level, what sequences the work should be done in and what this implies for changes in set up and programmes, are issues that the work group themselves are concerned about and on which they have a contribution to make.

For these reasons, it would seem that the new computer automated system requires a different management structure from the traditional line. It will tend, rather than being hierarchical, to be a flatter structure, in which many of the operational

decisions will be taken by the work group, leaving management with the 'boundary management' task of matching the outputs of the system overall, to the changing needs of the factory and its external environment. Thus, the manager in the new system will be more concerned about overall objectives in terms of output, deliveries, costs and quality than with the detailed direction and control of the labour force.

v. **Relationships with other functions**

A similar situation should perhaps apply to the areas of maintenance and quality control. In the traditional structure, the Engineering Department would take total responsibility for maintenance of the plant and equipment and all maintenance tasks would be performed by specialised, skilled maintenance personnel. The reasoning for this would be that it was assumed that every task required a skilled man to perform it and that by removing any concern for maintenance of the equipment from the operator he would be able to devote his/her sole energies to obtaining output.

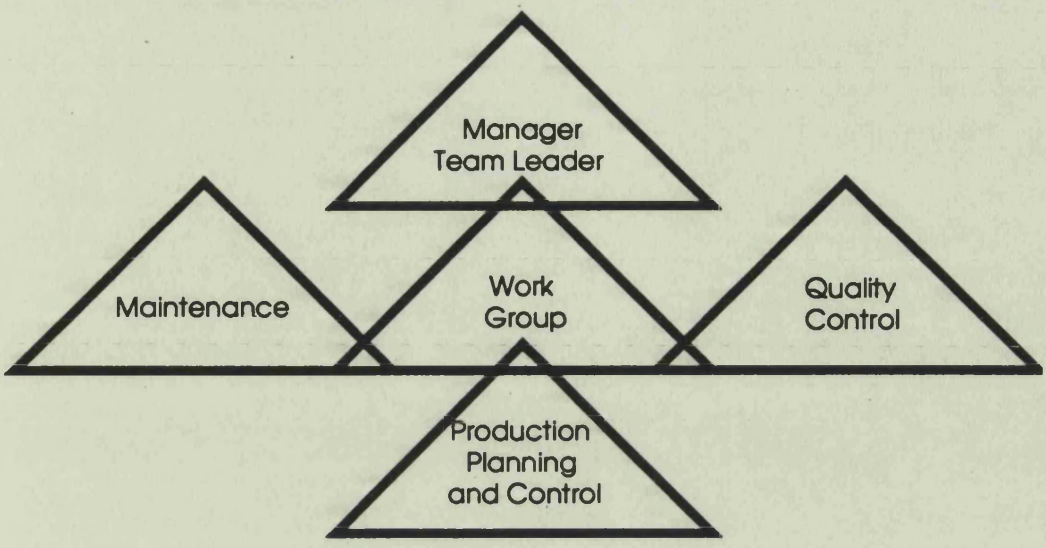
In the new system, much of the equipment will be self-diagnostic and therefore while the operators will not be able to rectify electronic faults, their close involvement with the operation and performance of the system will mean that they are very sensitive to possible problems and where maintenance services are required. Also, since one minor fault can cause the shut down of the whole line, as opposed to an individual machine, a close relationship and immediate response situation is called for from maintenance. For these reasons therefore, apart from the added sense of involvement that it affords, a closer relationship and breakdown of traditional boundaries is called for in the new system between production and maintenance.

Similarly, with Quality Control in the traditional system, inspection was considered to be a separate function and full time inspectors checked all, or a sample of, the production operatives work. Apart from the overhead costs incurred and the implied assumption about the ability and responsibility of the production workers, defining inspection as a separate function and stage in the production process added considerably to costs and throughput times.

In an automated system, the computer should eliminate human error and thus the need for 100% inspection. If the programme is right in the first place, consistency in quality should be assured unless there are other factors like faulty materials or equipment that cause quality problems. Thus again, rather than employing an extensive inspection staff, the work group themselves can assume greater involvement and responsibility for the quality of output from the system, which is both operationally and behaviourally more desirable. In these circumstances, the relationship between Production and Quality Control changes from one of detailed checking, to concern for the Quality standards. This can be achieved through the education and involvement of the work force in issues relating to quality and its achievement and in improvements in quality and its costs. Apart from direct involvement in the production system the involvement of members of the team in Quality Circle type activities would also clearly be helpful in achieving these objectives.

The emerging model of organization that is appropriate to computer automated system (see Figure 26) is therefore very different from a conventional organization. It breaks with many traditional and strongly held views and assumptions, both by management and the work force and their representatives. The adoption of such forms of organization, especially in an environment where these traditions have prevailed, is likely to be quite difficult and meet with resistance. Further, while the new models of technology may be apparent, those of organisation are less immediately obvious. For these reasons management and the work force may be inclined to stick with the models and assumptions with which they are familiar and feel safe.

Figure 26 **New model of production organization in computer automated manufacturing systems**



Yet while this situation remains, we shall continue to get a mismatch between technology and the use of human abilities which can cause not only dissatisfaction amongst those directly concerned, but also resistance to what in other respects are desirable and necessary changes.

How can we break with traditions and attitudes of the past? How can we help management, technologists and trade unions to appreciate the wider implications of these technological changes? How should these newer models and concepts of organization be introduced? How can we ensure that a total system approach is adopted? What part should job design take in the development process and how can this best be achieved?

Role of management - values, assumptions and attitudes

As has been discussed, much of the problem in the introduction of new technology is not due to the technology itself, but rather the way in which it is introduced. In the robot case study, while the computer has the capacity to release people from the tedious manual tasks to exercise greater discretion, problem solving and decision making in relation to the process, the way in which it is introduced often has a

diametrically opposite result. Thus, relatively skilled, intelligent people are reduced to loading and unloading components onto a conveyor, while senior management and the computer make all the decisions relating to the process.

Managerial prerogatives

This, I believe, has much to do with the values, assumptions and attitudes about the role of management in organizations held by management themselves, but also, to a large extent, by the workforce and their representatives. As the preamble to the Engineering National agreement says 'Management will manage and the Trade Unions will exercise their functions'. Thus, management is seen in terms of a right and a prerogative exercised on behalf of the owners by certain designated people whose values, it is felt, still coincide with the owners of the business. However, as the analysis of the robot case study shows, management decisions relating to planning, organization and control, need to be taken at many levels and, as a consequence, need increasingly to be shared within the business. In this respect our situation in the UK contrasts with countries such as Denmark, where national agreements specify collaboration decision making, not only about the strategic development of the firm, but also at an operational level.

Management, as an activity, would be better viewed as a 'Process' rather than a "God given right', to which many people in the organization can and should contribute if it is to be effective and accepted. This view of the 'process' of planning, decision making, problem solving and control fits much more closely to the 'process' of manufacturing now being employed than the traditional hierarchical model.

Managerial control

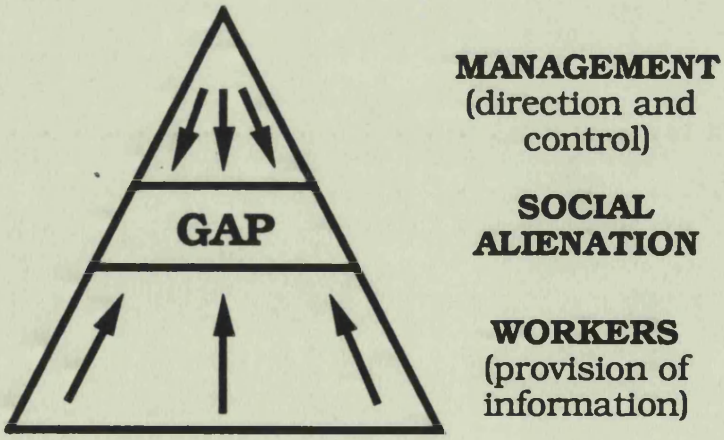
It further relates to managerial motives in the way that new technology is introduced. The mainframe computer accentuates the trend towards centralization of control since it was necessary for all information to be fed in centrally to the computer, thus providing management with custody of the information and the means of control. The advent of the micro computer has the potential to reverse this trend since it is now economically possible for decentralised departments and units to collect, process and maintain their own information and control their own activities. However,

this possibility may run counter to management's motives in computerising in the first place. Management may see the more ready and rapid processing and collection of information as a means of exercising more effective control of the business and its operating parts. They may also see a threat to their own positions of authority if the information on which their ability to control is shared. Thus, fundamental to the way in which new technology is introduced, are the motives (not necessarily overt or outwardly recognised) of management in the instigation of the computerization process.

Managerial role

The fact that information can be collected, processed and maintained at a local and opeational level as a result of developments in new technology, does throw into question the whole basis of the traditional concept of the management role. In a functionally organized company with specialised tasks, without a computer or having a mainframe, it was essential for management to collect information in order to co-ordinate and control activities. Thus, the emphasis in this situation is on a hierarchical management structure in which the workers do the work and where management collects information on output performance, stocks, quality costs etc, in order to plan, co-ordinate and control the operation. This led, as some writers have pointed out, to a gap between those that do the work and those who process the information and make the decisions (see Figure 27).

Figure 27 Hierarchical Management Structure



With the introduction of microcomputers, where a work group can readily have their own information on all the above factors via a VDU, the work group itself is in a position to undertake its own operational planning, co-ordination and control. This, therefore, raises issues about the appropriate nature of the management role in these circumstances. As was evident in the robot case study, it would appear that the job of management shifts from one of detailed direction and oeprational control of staff and activities, to more of a strategic role in terms of development both of the work group as individuals and as a team, but also in terms of the efficiency and effectiveness of the operation and its development. Thus, it is increasingly unlikely that the work group will require direct supervision in the traditional sense and that management will become more concerned with training the skills and attitudes of individuals and communication with, and development of, the group. They will be concerned with issues such as productivity and quality, but more in terms of how this can be improved and developed than by direct intervention and control. Thus, they are likely to work in conjunction with the other departments concerned and with a group in defining and improving standards in these areas. Thus, management's involvement with the work group in a Quality Circle mode might be one of the ways of achieving both the social and economic objectives referred to.

From this analysis it is evident that with such a delegated style of management, greater emphasis would be placed on the 'boundary management' aspects of the role, namely the relationship with other functions and levels within the organization, representative of the group and their interests, plus communication back to the group on company wide issues and development.

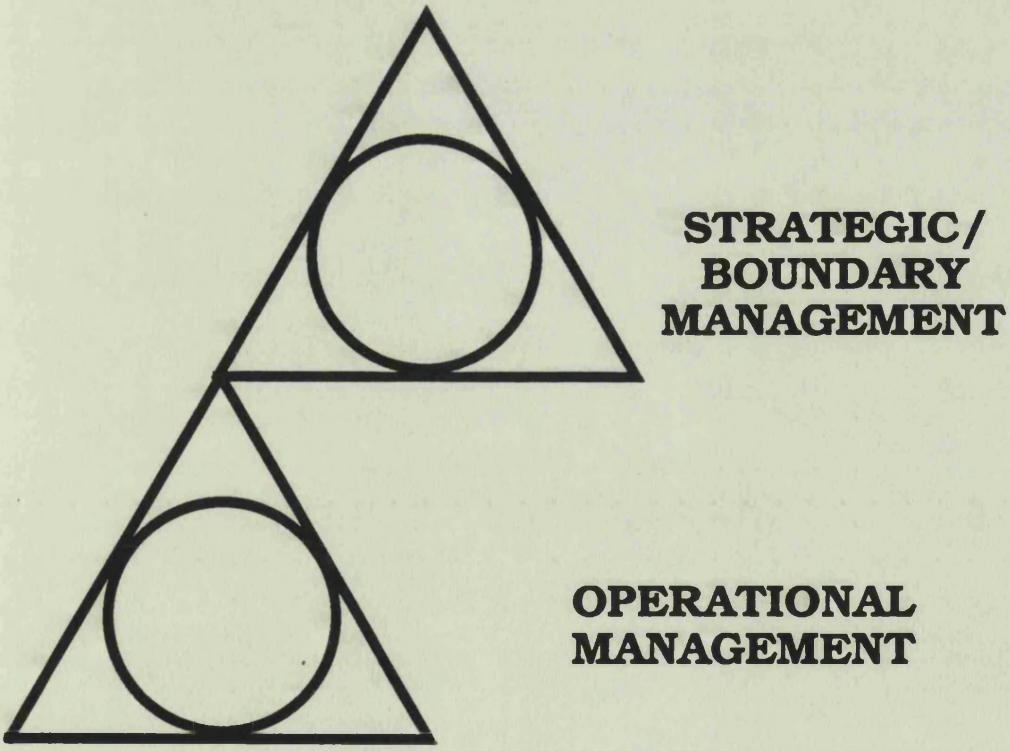
Strategic and operational management

Group Technology requires Group Organization as shown in Figure 28. To fit an automated situation in which the computer is in effect performing the manual tasks, the work group are, in effect, managing the operation, thus releasing management to concentrate on the necessary strategic and boundary management tasks. In this situation all are involved in the 'management process' apart from the greater efficiency achieved by computer aided automation potentially the 'gap' and social alienation familiar with traditional forms of organization may be reduced. Whether these results

are achieved depends to a large extent on the assumptions and motivations of management in introducing the new technology. If, as is often the case, the motives are cost reduction and the elimination of the unpredictable human factor, then it is unlikely that the strategy outlined above will be employed.

If, however, management value the human contribution as perhaps the most flexible manufacturing or information processing system and see the computer as a possible extension to his decision making and problem solving capacities, then alternative ways of matching people and technology are likely to be employed. In these circumstaces management's assumptions and motivations may well be about increasing overall organizational effectiveness rather than simply reducing costs and, in the long term, this may well bea better route to profitability and survival.

Figure 28 Group Organization/Technology



PART IV

CORPORATE CULTURE AND TECHNOLOGICAL CHANGE

The final stage of the research has involved an examination of corporate culture and technological change. The two cases have been chosen because they illustrate attempts to change not only the technology and organization of work but also the corporate culture of the companies concerned.

The first of these describes the approach adopted by British Telecom to improve their customer service through the introduction of what they describe as a 'front office' capable of dealing with 80 - 85% of all customer queries. This involved the development of a customer service system of information based on a new computer system together with the introduction of customer service section of specially selected and trained staff.

The second case is, by contrast, an example of a company on a green field site, who have sought from the start to develop a completely different corporate culture from the traditional approach to management and organization.

The company concerned, Dupont at Yate, have developed what they describe as 'The Bristol Way', a conscious and comparatively well defined culture that is publicised and promoted both within and outside the organization. The culture places a very high premium on the involvement of people as the key resource and the employment of appropriate technology to give the customer the service they require in terms of product, quality, delivery and price.

CHAPTER 12 - COMPUTERIZED CUSTOMER SERVICE SYSTEM - Employee Involvement and New technology at British Telecom

The fifth case study: origins and involvement

My contact with the changes being made at British Telecom was at three levels, firstly with those responsible for systems development, secondly with those concerned with the management of the whole project in Cardiff and thirdly with the Organization Development Unit in London.

I was able to visit the OD Unit in London and establish contact with the group and the occupational psychologist concerned and was able to maintain contact with her during the introduction of the new system.

Finally, I had established contact with the Area Manager at Newport who was then appointed as District Organizational Development Manager. This has enabled me to maintain my contact with the organization after the change was completed and the project team disbanded.

During the summer of 1985 I attempted to obtain funding to support my involvement with British Telecom, through the SRC Open Door Scheme, but internal sensitivity prevented this coming to fruition. My role has therefore been as a detached but interested observer rather than being directly involved in job design. This has, in retrospect, been very valuable as I have been able to observe the use made of job design and organizational development techniques and resources within the organization rather than being involved myself with job design. This has enabled me to adopt a more detached stance in relation to this particular development.

My work focused on the approach adopted in South Wales district, which employs some 6,000 staff. I made a number of visits to the pilot installation where with the co-operation of the customer service staff, I was able to visit the installation and learn about its introduction and operation.

Data collection

Whereas perhaps my earlier studies started out at the operations level and progressed to strategic issues, this study, if anything, started at the strategic level and subsequently progressed to issues at the operational level.

In this case data collection started when I learnt about the planned changes in British Telecom at a Policy Unit Conference at Aston University. Here I met the manager responsible for the development of their computer system who was very sensitive to the human and organizational issues involved. Through his auspices I was introduced to the Project Manager for the CSS (Customer Services System) and was able to meet with him and his colleagues to discuss the development and their approach to its introduction. Through the Project Manager I was introduced to the District Manager for Newport, which was to be the pilot site in South Wales for CSS. It was my objective to be able to follow the change at first hand and, if necessary, provide professional job design advice. However, as the sensitivity of the situation and trade union attitudes prevented external involvement, I was pleased to accept the opportunity to work through the OD Unit in London who were involved in the project as a professional resource in OD and job design.

While I had the opportunity to observe both the old and the new systems and talk to the staff informally, I was unable to conduct a job diagnostic survey directly myself. However, the Occupational Psychologist involved used a questionnaire that they had developed which is shown at Appendix 5. While I was not able to obtain the results of their survey direct, its value was in demonstrating their approach both to job design and the introduction of the changes.

From my informal discussions with the staff during visits both before, during and after the change, I was able to obtain a good impression of the jobs and the new system and of the staff reactions to it.

In this case therefore the focus of my data collection has been more concerned with the strategic aspects of systems development and organizational change than with the data's effects on job content. It was more about the strategy adopted to bringing

about change in a technically orientated organization, and it is in this respect that the case study is particularly relevant.

Improving customer service

With deregulation, which involves opening up competition, the communications industry, like many others such as banking and finance, has become increasingly competitive and British Telecom, like others in the industry, was concerned to improve its competitive position.

Following a report from Mackinzies, a major firm of management consultants, which emphasised the need for greater customer orientation, the company launched a programme of decentralization, creating Districts providing greater local autonomy, with the aim of improving both business efficiency and customer service. An important part of this programme was an improvement of their customer database through computerization, and the development of a customer service function that could handle up to 80% of the enquiries received, which they called their front office.

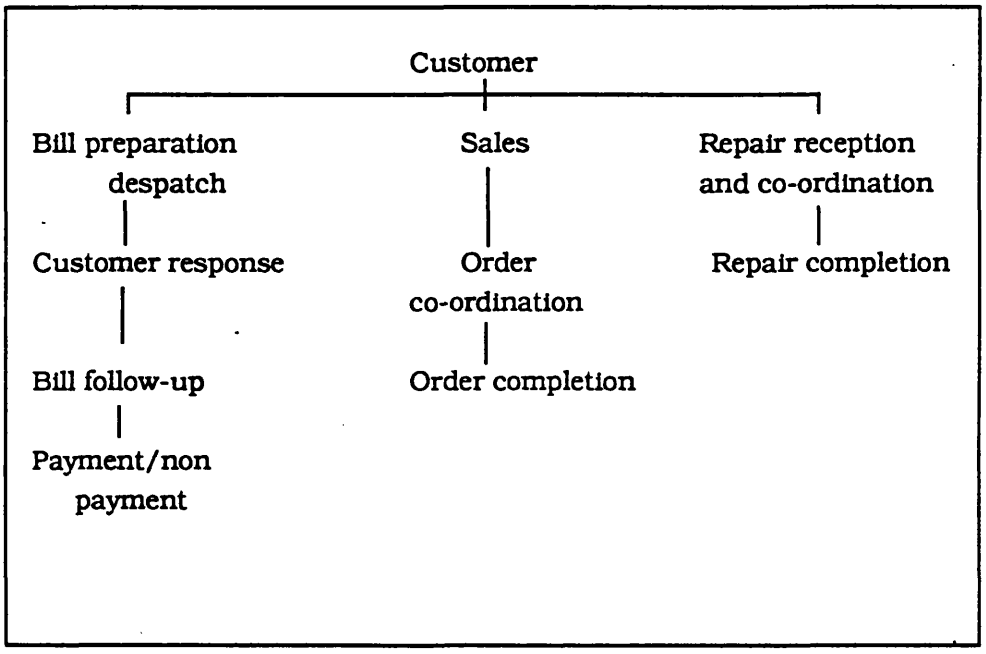
From the outset, the company recognised that this created an opportunity to make changes to the organization and to peoples' jobs, as well as to the technical system. Thus, the change and the use of new technology was seen as a major element in the company's business strategy to improve customer service and ensure its continued development and profitability.

Pilot schemes for their customer service system were launched in several districts and while each district was able to adopt its own approach to the development, a central office was available to provide back-up support, both in terms of the technical developments and also in terms of organizational development and job design.

Previous situation

In the previous situation, customer enquiries and requests were handled by several separate specialized departments, each of whom kept their own customer service records. These were largely on a manual basis, maintained and updated by clerical staff attached to the department concerned. The previous organizational structure, which was acknowledged as being somewhat functional and hierarchical is shown as figure 29.

Figure 29 Previous Organization



Personnel Department did a survey amongst the staff. Comments highlight some of the problems associated with the original structure, eg.:

"Information not easily available"

"Need to cut down on the paper work"

"Separate working groups do not keep each other informed.

"Parochial views of their own functions, eg sales and billing"

"Records poor and inaccurate. Records about customers will be kept in 15 different areas!"

These comments were reinforced by my own impressions, when visiting the old system at Newport, of a very antiquated system with masses of loose files with tatty paper records kept in very depressing dingy offices.

Thus, within the company, there was a recognition of the problems and the need for change. The existing organization was cumbersome and inefficient and lacked adequate customer information and orientation. This created problems and frustration for the staff and undermined the service they could provide for the customer.

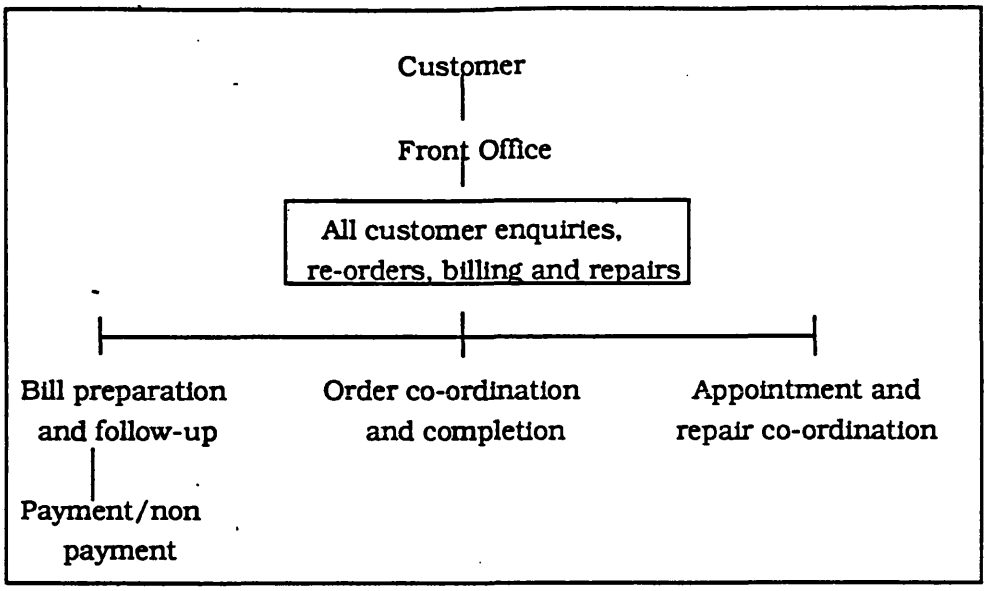
The new system

The new system was based on the overall concept of a customer service unit which is seen as the **front office**, able to deal with up to 80% of all customer enquiries and requests. The object was to get as near as possible to the '*one stop*' shopping concept where staff who are suitably trained and motivated can, with the aid of a computer based information system, process the majority of customer queries and requests. Today's customer expects responsiveness, commitment, action and feedback and this is what the new organization and its accompanying technology was designed to achieve.

The new computer system, which was developed by the company's own staff, was based on an IBM mainframe computer of 60 kegabites, providing an integrated database and 1000 terminals throughout the district. It provided **front office staff** with the record of existing customers and all the information the may require in order to process enquiries about sales, billing, maintenance problems and requests.

As frequently occurs with the introduction of new technology, the opportunity was taken to redesign the physical layout totally. A new, purpose built office was introduced on the site which provided the staff with excellent facilities. These included new purpose built office furniture, different lighting, and a raised carpeted floor all of which created a very pleasant light and spacious working environment. Front office staff were provided with a direct computer link with the specialized departments concerned and the revised organization structure is as shown over.

Figure 30 New organizational structure



System operation

Incoming telephone calls were added to a queue, the first in the queue being taken by the first available operator. At the time of this study the average waiting time for a customer call to be answered was 11 seconds. As an example, one of the operators studied received a request from a customer for a disconnection as the subscriber was moving out of the area. In the space of about two minutes the operator arranged for the disconnection to be carried out, deleted the subscriber from the directory and arranged for the final account to be raised and despatched.

Staff reactions

From the staffs' point of view the operators said that they preferred the new job to their former role, eg in billing. It is much busier, more varied dealing with sales, accounts and fault enquiries. The staff in the front office wanted to be near and committed to the customer and it was felt there was a good atmosphere in the office. However, their work was paced to the extent that they have to follow up calls which were waiting and which were indicated by a light on the console. Also, they felt some pressure and responsibility but there was a feeling of not wanting to pass the query on. In practice, staff were dealing with a higher level of enquiries, near 87% rather than the original 80% target and may have to handle up to 50 different types of call. At the time 28 staff were dealing with an average of 2,000 calls a day, an average of 71.5 calls per operator per day.

Preparation for the changes

From the outset, the approach adopted to the introduction of the change by the project management team was that commitment to the new system would only come from involvement. Thus, it was necessary to obtain the commitment of the Board to this development and to answer their questions about the new system. Once the framework had been agreed by the Board and a report outlining the plan had been produced, the project team would delegate the work of introduction to each area.

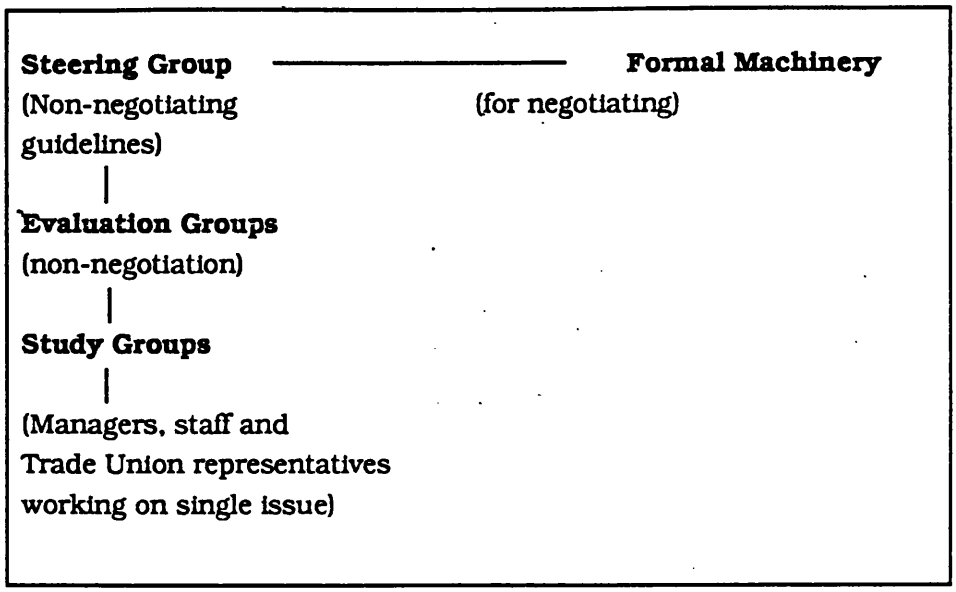
The Trades Unions who were concerned about possible job losses and changes to job content, were invited to participate in the planning process and to join in steering groups. Although it took some three months for the Unions to decide to participate, an open consultation process was achieved with representatives from six trade unions involved on the steering group which meet at monthly intervals. Both management and employee representatives agreed on their lack of knowledge of the new system and therefore drew on a group of specialists and experts to advise them. Both management and grade staff were sent off to learn about the new system.

This joint learning and problem solving approach was further emphasised by the formation of a number of '**study groups**' involving staff at the lowest level in aspects of the development of the new system. The stated aim of the study groups was to encourage ownership of the new system at the basic level of the organization, by involvement in the planning process. Typical issues examined by the study groups would be how the new system would effect the billing department and how to manage the introduction of the new system. The structure of the consultative process can be illustrated as in Figure 30.

Selection, job design and training

The development of the technical system was linked with a high level of participation of staff and with a comprehensive training programme for front office personnel. A specialist front office trainer was appointed at the site and with the aid of an Occupational Psychologist from the Head Office, staff were invited to participate in a pilot study in the design of their own jobs and in the final detailed aspects of the system development.

Figure 31 Consultation Structure



From the outset, it was recognised that a high level of training was going to be necessary to change the way people thought about their job. While people were invited to apply for front office jobs on a voluntary basis, most of the staff only had experience of one of the specialist functions, eg billing, sales or repairs. Also, they had been based in the departments concerned and tended to be more orientated to their function than to the customer.

The approach adopted therefore was to lead people into the new situation gently and to let people '*walk before they ran*'. They were invited to describe how they would see the new job, what queries should be dealt with and what depth and what training they would require. They were also consulted about the number of calls they thought they would handle, how long a customer should wait, number of staff required and the decisions that they would be prepared to make. Finally, they chose their own office furniture and had some influence on the ergonomic aspect of the design of the new system.

In describing the pilot study, the company's occupational psychologist explained that they set very limited objectives for the first six people involved in what was a process of participative job design. The company's main aim would be for them to

familiarize themselves with the new system. Help and advice was offered on a '*take it or leave it*' basis but was not imposed. With the aid of a questionnaire developed by the head office, staff were invited to consider what aspects of thieir current job they didn't like and what they would do to change it. Thus, the initial objectives were to:-

i. Learn the new system
ii. Take over the billing enquiries
iii. System navigation and customer records.

After the first fornight, things were going well but differently to what had been expected. The original manager was not happy with what the new job involved and was not used to a situation in which the staff are able to define their own jobs. The environment had been much more formal and bureaucratic, whereas now the staff were in an open office, stopping and starting work as they saw fit and reviewing their own performance and progress. Initially, there had also been some reaction from the group to working in this way as it was very different from what they had experienced. However, following the appointment of one of the members of the support staff as a group leader they now seemed to be responding very well and identified more with the objective of providing a service to the customer. It was felt that a considerable change in attitude had already occurred in the first two weeks, with a much more positive attitude to the job and a wish to become more involved.

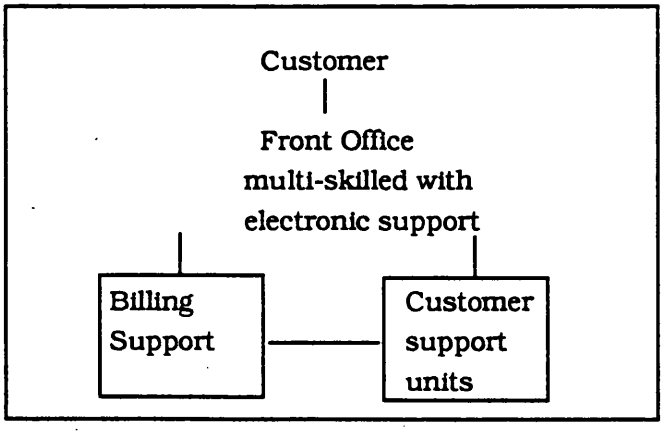
Benefits and future developments

From the company's point of view, the new system has provided many benefits and opportunities amongst which the following were highlighted by the company:

- The introduction of a front office concept
- Removal of artificial barriers within the organization
- Dispersal of operational controls
- Centralization of operational information
- Terminal driven jobs
- Flexible work load management
- Maximising responsibility
- Reducing the grade structure
- Convergence of administration and operational tasks
- Exploiting information
- Territorial/functional review
- Training

Having got the initial system into operation in the pilot area, it is envisaged that further development will involve looking at the end user and the management of problems and enhancements to the systems. Customer service staff are now responsible for training and a team of trainers and a training package has been developed. The company envisage moving to a flatter structure and where the computer system will provide greater integration of all the functions concerned. (see Figure 32)

Figure 32 Integration of functions



Conclusions

While no systematic data is yet available on the levels of satisfaction of customers or of staff, it was evident that this development is seen as a very important part of the company's business strategy and future development. It marks a distinct shift from a bureaucratic and technically orientated organization to a market and customer centred service operation. This has called, not only for more advanced technology and computer based systems of information and integration, but also for changed attitudes, jobs, organization and communication patterns.

Because of the far reaching nature of the changes, those responsible for planning the project have recognised the need for involvement of all concerned at the earliest feasible stage. This level of consultation and participation does appear to have borne fruit and provided that this change of climate is maintained should facilitate further development.

Finally, it does illustrate that the introduction of new technology need not be at the expense and satisfaction of the staff concerned, but can lead to more varied and satisfying jobs for the people concerned if it is planned this way.

It does, however, demonstrate that change of this scale calls for resources and investment not only in the development of the technology concerned, but also in the human, social and organizational aspects and implications of the change. The experience that British Telecom has gained in this case should help in future developments

While I have sought the company's permission to publish a version of this chapter as a on the introduction of CSS, commercial and trade union sensitivity has prevented this so far. I have received favourable reactions from their manager of organizational development, but negotiations over the introduction of CSS nationally has prevented them from attracting any undue publicity for the change.

However, for the purposes of my research the case has proved very valuable and some of the key issues arising are analysed in the following section.

CHAPTER 13 - DISCUSSION OF THE CUSTOMER SERVICE CASE

Management strategy and the need for change

Recognition of the need for change came about largely by a combination of changes in the external environment in which British Telecom operates.

Firstly, changes in the political climate has lead to deregulation in the tele-communications industry which has opened up the network for private enterprise and competition from other providers. This and the Government's policy to end British Telecom's monopoly of equipment sale has meant that they have moved into an increasingly competitive market. Add to this the very rapid technological changes in the communications industry and it can be seen that the environment in which the company is operating has become much more complex, competitive and subject to rapid change. The intention has been to give the consumer more choice and to give greater expression to market forces.

Colin New (1978), in his paper on 'What we need is a Marketing and Manufacturing Strategy', explained the need for the internal organization to match the external environment in which it is operating. Traditionally British Telecom with its historical background as a public utility has had a rather bureaucratic image and structure and has tended to be production rather than consumer led. The changes in the external market now called for a substantial shift to a more market and consumer orientation which would need to be reflected back into the structure and style of the business.

It was recognised by those responsible for developing customer services that the current structure with its departmental barriers and manual systems of information would not be sufficiently responsive to give a fast and efficient service.

Thus, the strategy in the new situation was to give a greater priority to customer service and the speed with which information, advice or action could be taken.

However, while it was recognised that technology in the form of a computerised data and customer services system could help to improve the efficiency of the service a premium was placed by the project team on the involvement of people in the new system and its development. There was the recognition that people, particularly in a service function are extremely important and that their attitude to the customer and the efficiency with which they could handle their queries is all important to survival in the current climate.

Thus, the concept of the front office as the interface between the customer and the organization was conceived. This was intended to provide the equivalent of the 'one stop shopping' concept where a properly trained and motivated staff with all the backup that the organizational and technical system can provide could handle up to 80% of a customer's needs.

Systems Development

There are a number of significant factors in the approach to systems development adopted in British Telecom and some interesting comparisons to the Ushers order office case study.

At British Telecom the primary motivation for the development of the new technical system was to improve customer service. Customer surveys showed that customers would be referred to many different people leading to confusion and lack of a co-ordinated response. The development of the system was therefore clearly linked to overcoming current problems in the strategic objectives and development of the organization.

Although the system was developed centrally it was designed in such a way that it can be adapted to the needs of the local situation. The problem in the past was in having a large central Head Office which could be out of touch with local needs. However, in this case staff from the regions were co-opted and seconded to the centre. Thus the end user was involved in the development of the new system.

The technical staff concerned were also aware that the technical system would have organizational and communication implications in that it cut across existing functional and trade union boundaries.

Thus, as apposed to the centralized and deterministic approach adopted for example in the Ushers order office case, British Telecom demonstrated considerable sensitivity in their approach to the technical systems development. In particular they recognised its implications for strategy, integration and participation.

Job design

The British Telecom case is also very interesting in terms of their use of and approach to job design. In the first instance there was a clear recognition of the need for job design in the introduction of the new computer based customer service system. This recognition may in part have been enhanced by the fact that a new job was being created involving elements of the previous functional tasks (mainly billing, sale and repair). But it is important and significant that the company particularly recognised the need for job design and were willing and able to devote the necessary resources to the project. In this respect an occupational psychologist well versed in job design concepts was seconded to the South Wales Region for a period of several months to work exclusively with the staff involved in customer service system on the development of the new jobs and the staff concerned.

However, apart from the fact that they recognised the need and were prepared to allocate approrpriate resources, it was also interesting to observe the strategy adopted to job design. In the first instance help and advice in terms of job design was offered on a take it or leave it basis and was not imposed. The occupational psychologist was available to help the staff with their queries and problems as they arose. A questionnaire was used to seek opinion of staff about their current jobs to how they felt they would be improved (see Appendix 5).

Initially a group of the staff were selected from existing functional departments to be trained for the new customer service system front office job. The approach adopted by the occupational psychologist was initially to work with this group of staff to

see what they were doing to possibly advise on job design when needed and to talk with the manager about the problems.

Having established contact and a 'rapport' with the group they were able to agree limited initial objectives as regards the development of the new jobs. In this first instance, the staff would concentrate on 'learning the new system. Having done this they would then take on billing enquiries before progressing to system reorganization and customer records.

Eventually when the staff had gained confidence they would take on the other functions of sales and repairs but as can be seen from the above the approach was very much one of work organization development and the progressive development of the job and the staff through involvement and consultation.

Their attitude towards the introduction of new technology was that job design is relevant and necessary. It requires resources and expertise which should be offered to those involved rather than improved. Job and system design should also be on a participative and incremental basis.

This contrasts dramatically with the Ushers case, where none of the above factors applied with predictable results, particularly as far as the staff are concerned.

Departmental relations

As mentioned in Chapter 11, in my paper on Organization and Management for New Technology, one of the implications of computerized systems of information is the opportunities this can present for the greater integration of related functions. In this case although there was an awareness that the introduction of the customer services system could have implications for communication and the relationships between billing, sales and maintenance which were at the time quite separate functions.

The fact that customer services has access to the information on all these aspects could facilitate greater integration and teamwork between these functions for the benefit of the customer.

Although I was not able to carry out any structured research on the related functions, informally there was some evidence that little change in attitude had occurred in them. In one instance for example, the front office staff had great difficult in getting someone from accounts to respond to a customers query. From the apparent attitude conveyed, it appeared that accounts staff did not share the same objective as the customer service staff.

While opportunities for developments were recognised by the company, it was felt that any structured integrative change to achieve this would represent a further stage in organizational development. It is not clear at present how and when this might occur.

Management style

However, while the needs and opportunities for change in terms of structure appeared to be recognised, it is not certain that the same can be said for management style. There are some indications that there was resistance amongst line management to the delegation of responsibility and greater autonomy for CSS and other staff.

The company has a history operating with a rather bureaucratic, hierarchical structure in which people are expected to be told what to do. However, the introduction of a system which gives staff greater access to the necessary information for decision making may call for some change in the style of management appropriate to this new situation. In particular, if staff are able to make the necessary operational decisions this should free line management to concentrate more on other development of the people and the system and to operate with a more delegated style of management. How far this has been recognised is not clear. At present there is some evidence that the prevailing style of management is acting as a constraint on the further development of the customer service concept. Thus in terms of further development of Customer Services and the quality of staff and service given, it may be that management development, particularly in relation to the role and style of management is appropriate to the new situation would be a priority for the company.

Management of change

Although in many ways effective, there is some evidence from the case that the level of analysis adopted in terms of planning the change, may have been wanting. While they recognised the human implications, and adopted a participative approach to job and systems design, the form, in terms of organizational change, was still based at the level of the individual rather than in terms of developing the team. Thus, changes were made to the jobs of the front office staff, without any apparent complementary changes in other related functions, such as accounts and enquiries.

In the end, improved customer service will come from more effective communication and co-operation between all those who need to work together to give the customer the service they need, and this implies improving teamwork as well as individual job design.

Conclusion

In many senses this case study demonstrates an attempt to use the opportunity provided by new technology to achieve a significant change in culture of the organization concerned. It is an example of a traditional inward looking bureaucratic and technically orientated company, recognising the need for change in order to survive. Aided by the opportunities provided by new technology, the company was seeking to become more outward looking, customer oriented, people centred and dynamic.

While they would be the first to recognise that there is still a long way to go, their initial efforts do appear on the face of it to have been quite successful. While further research would be needed to measure the effects on customer satisfaction, the effect on employee motivation amongst office staff at least have been positive. In planning the change they have been sufficiently far sighted to recognise the implications of technical change for job design, and work organization and for the selection and training of staff, for the structure of the organization and relationships between departments. However, while significant progress has been made on these factors in terms of change, there is some indication that current management attitudes and style may hinder further developments. This must be a concern for the Directors and Board of British Telecom because commitment at this level is essential if the changes are to be effective.

CHAPTER 14 - AUTOMATED MANUFACTURING
A New Way of Operating at Dupont

Sixth case study: origins and involvement

My initial interest in Dupont at Yate arose in early 1985 when I was involved with the Teaching Company Scheme. I learnt from my engineering colleagues that the company which had opened very recently was very advanced both in terms of its use of technology and also in the style of management being adopted.

Following this, the Polytechnic was asked to assist in developing an automated system of quality control and I was invited to be part of the joint Polytechnic and Company advisory team. In this capacity I drew the attention of those involved both from the Polytechnic and the Company to the importance of analysing the effect that this might have on staff attitudes towards quality. In a situation where the functions of inspection and statistical quality control was to be automated, an attitude of indifference could arise amongst staff who considered that the computer had taken over their responsibility for achieving good quality.

The advisory team was very responsive to this view since they had set a very high premium on quality as one of their key strategic objectives. This, plus the fact that they considered that the involvement of their employees was a further essential ingredient to their success, influenced their approach to the project from the start.

Following this, I made a study of their particular approach to management and organization which they described as the 'Bristol Way' and prepared a brief paper on this for the project committee. This paper was well received and provided the opportunity for my further involvement with the company (see Working Paper 1).

More recently, I was invited by the Manufacturing Manager to advise them and help them in the development of the 'Bristol Way' in practice. This has involved an examination of their approach to self management and team work and how this can be further developed. This has given me a unique opportunity to examine the nature of the corporate culture in practice and to observe its effects particularly regarding technical change and organizational development.

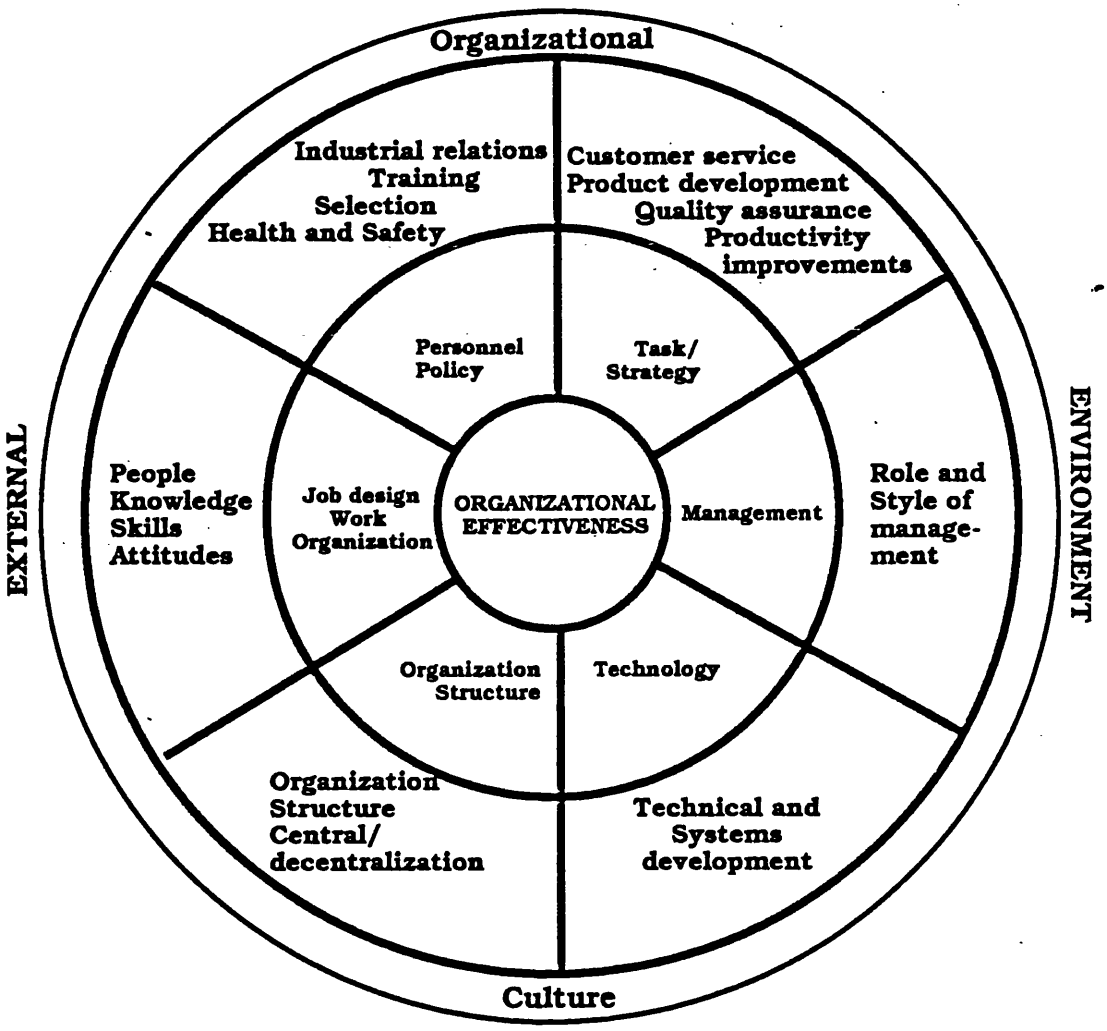
Framework for investigation

From my own earlier investigations, and my involvement at the Budapest Conference in 1986 as a rapporteur, and from my reflections to Stage III of the research, I was able to identify what, I believed, were some of the key factors and variables that influence the effection introduction of new technology.

These variables and their relationships, which are illustrated in Figure 33, helped to provide me with a framework in which to collect data and analyse the Dupont case.

* **Culture**	the prevailing culture, beliefs and values of the organization and its influence on the introduction of new technology
* **Management Strategy**	company goals for improved customer service, competitiveness, product design and quality, and the envisaged plans for achieving them, eg introduction of new technology
* **Technology**	the approach adopted towards system development, the degree of participation in the design process, the extent to which technical and organizational choice and alternatives are recognised and explored.
* **Organization Structure**	the extent to which there is recognition of the impact of computer systems on organization structure and the integration that can be achieved by information technology.
* **Management Style**	the opportunity created by computer aided automation for a more delegated management style.
* **Job Design and Work Organization**	the opportunities to adopt alternative forms of work organization, eg moving from specialized individual jobs to more flexible forms of group working.
* **Personnel Policies**	industrial relations, training, appraisal and reward system, selection, health and safety.

Figure 33 Key Organizational Variables for Introduction of New Technology



This illustrates the fact that the culture of the organization is, in effect, the sum of the approaches adopted by people in the organization to the variables concerned and their interdependence. The prevailing culture profoundly influences people's openness and sensitivity to external environmental changes and their willingness and ability to influence and change the key variables concerned. However, it is those organizations that create a sufficiently supportive climate and culture that enable people to respond and adapt to change. These, organizations, as the model shows, will be better able to adapt to change and maintain their effectiveness to meet the challenges of today's changing environment.

In terms of my research therefore, the first stage of my investigation was to establish what the company were trying to achieve in terms of its culture, its strategy, structure and style. What was their intended approach to the use of technology and the related involvement of people? What is their attitude to the involvement of people and how they approach the introduction of technological change. From my discussions with members of the business team and from my analysis of their published documents and statements, I have analysed these factors as they apply to Dupont. The results of this investigation, form the basis of the rest of this chapter. They also provided the basis of the paper I presented as the first keynote paper at the EAISM conference in Yugoslavia in August 1988 on 'New Technology and Managerial Culture in the 1990's.' Later in the chapter, I discuss how far their ideas and concepts are working out in practice based on the evidence obtained from my survey into self management and team work in the company.

Data collection

My role and approach to data collection in this case has been one of a catalyst collecting and feeding back data on the key issues concerned with the development of the company, its culture and its appraoch to self management.

My initial investigations into the company, its culture and approach to people and technological change involved interviews with members of the business team and a study of company documents and papers on these topics.

However, as my investigations progressed, I was involved in detailed discussions with individuals and members of the self managing teams to establish how the culture and the 'Bristol Way' worked out in practice. This involved selecting a sample of participants from each of the 10 self managing teams who were representatives of the different grades and functions involved, eg Technicians, contractors, office and manufacturing staff. Discussions were held with each group to establish the nature of their work, how far they felt involved, their attitudes towards such things as team work, self management and communication. I used the Hackman and Oldham survey to form the basis of the discussions and to obtain objective feedback on the key motivational job characteristics concerned.

The results of the survey were analysed by computer and the results and my own commentary were fed back to the relevant self managing teams for validation and information. Following this I prepared an overall report summarising the findings which were fed back to the Business Team at a meeting to review the effectiveness of the 'Bristol Way' (see report on Self Management and Teamwork)

Since then I have continued in a catalystic role focussing more on the role of the leaders and their strategic icontribution to the development of the company, its markets, its structure, its people, its technology and its products.

The company

The Company, Dupont, who employ some 100 permanent and temporary staff, are engaged in the manufacturing of electronic connectors for use in the computer industry. They are operating in a competitive and rapidly changing market, where quality, delivery and customer service are as important as price. Despite the use of automated equipment, they are dependent on having high calibre technical and operating staff and have to compete amongst other engineering and high tech companies for the personnel they require.

They are in the high technology business and have developed close links with the Polytechnic and its academic staff. Although the company is a subsidiary of a large multi-national organization, it is encouraged to operate with a high degree of autonomy. The firm, which is located in the high technology corridor at Yate, close to Bristol, is expanding and is engaged in a programme of computerization and automation of its manufacturing and quality control processes, which it sees as a key factor in their strategic development. However, it is their approach to management and organization which makes the company of particular interest in that they have sought to develop a distinctive culture and management style. This, they believe, is not only appropriate to their business, but also given them a strategic advantage over their competitors. However, they also believe it helps to achieve effective involvement and utilization of both people and technology.

Business strategy

A key factor influencing the introduction and role of technology is the business strategy of the company. Whether computers and systems of automation are seen essentially in terms of cost cutting and labour savings as opposed to increasing the flexibility and competitiveness of the company has a considerable influence on the relative roles of people and technology.

In many sectors of business activity, whether in manufacturing or service industry, the criteria for performance and survival have changed. Whereas in the past the emphasis has been on increased efficiency and cost reduction, today many other factors are required. Organizational effectivness in today's changing and competitive environment places demands for customer service, quality, choice and flexibility as well as cost reduction and depending on how they are introduced computerized systems can make an equally effective contribution to these goals and the goal of increased efficiency.

Key goals in Dupont's strategy are a continuous improvement in customer service and quality and these factors influence their approach to organization, management and the people. For example, when customers visit the plant it is often the staff who show them around rather than members of the business team, which helps to instil confidence in both the customer and employees. It is stressed that everyone is in a customer/supplier relationship and this is intended to emphasise the responsibility that all staff have for customer service. Similarly, in terms of quality and the automation of quality control, it is felt very important to retain the commitment of all employees to this goal. Thus, the automated systems are designed to enable staff to monitor their own production and quality performance so that they can manage and take corrective action themselves. Thus quality assurance is seen as an integral rather than separate function in the manufacturing process.

Corporate culture

Recent research has focussed on the significance of the culture of an enterprise in helping to adapt to change and increase effectiveness. A conscious consideration and declaration of the philosophy, values and principles that the organization stands for can help both employees, customers, and all those who have a stake in the business

identifying with what the business, or board, or management is trying to achieve (Bailey 1984). The work of Peters and Waterman (1982) and of Clutterbuck (1984) demonstrate that those factors such as leadership, management style, attitudes to employee involvement, commitment to quality, continuous improvement and closeness to the customer significantly affect an enterprise's performance and ability to adapt to change.

From the outset, Dupont at Yate have sought to develop a different culture from the traditional approach to management and organization. Influenced by people such as Deeming and their approach to total commitment to and involvement of people in quality, customer service and continuous improvement, the Company have developed a concept of 'a different way of operating' which they describe as the 'Bristol Way'. Although initiated by the original site manager, Terry Ennis, the involvement and participation of staff and the technicians achieved considerable commitment to these new concepts and what has become 'the Bristol Way'. Many of the staff came from traditional engineering backgrounds and environments such as Rolls Royce and British Aerospace, and the contrast and opportunity to be treated as a responsible member of the team was like a breath of fresh air and a new experience for many of those involved.

This culture is protrayed in the statement and 'core beliefs' contained in the document entitled 'A Different Way of Operation' and the document and its fundamental principles is given wide internal and external publicity. (see Working Paper 1, Appendix 11) Apart from being displayed in about every office and conference room, all the company are very open about their approach and welcome visits and comments on the way it works in practice. I have been able to take several groups of students to the firm and no constraints have been placed on who we can talk to and what questions we can ask. Similarly, they value visits from other firms and at my suggestion are participating in a Quality of Working Life Group and are hosting a visit from other interested companies.

All new employees, whether permanent or contract workers, are given a thorough induction to the company and the Bristol Way in particular and having sat through this, I was impressed by the sincerity with which this was done. Similarly, they have

recently commissioned a video from the Polytechnic to illustrate the Bristol Way in practice and this helps people to better understand what these concepts actually mean.

However, the company is the first to admit that while this may be their intention, it may not always work in practice. Pressures of time and production may make people slip back into more traditional modes of operation where people are told what to do and are subject to external discipline and control by management. Similarly, technicians may try to act as a supervisor directing and controlling staff rather than encouraging staff to take responsibility for their own performance.

It was for this sort of reasons that the company asked me to help them review the effectiveness of the 'Bristol Way' in practice and how far the ideas of self management and team work were working out in practice. The discussions I have had with the business team and in carrying out the survey, have enabled me to form a first hand impression of their corporate culture in practice and how it can be developed and improved.

Management style

Of particular significance in the introduction of new technology is the style of management. As can be seen from Appendix 1, statements such as not having top heavy management, not policing people and development of an atmosphere of trust, are intended to all imply a certain style of management with a high orientation towards people. The intention is to delegate as much r esponsibility to the people doing the job as possible, creating local autonomy and accountability through self managing teams. This is reflected in the roles of members of the business team who are described at present as 'leaders' in that they should provide leadership, support and advice to the teams and the people doing the job, rather than direction and controlling them in a traditional manner.

The concept of a delegated style of management is perhaps best illustrated by their recent introduction of the concept of 'peer group' assessment for all full-time permanent staff. Under this system a member of staff identifies three colleagues, a

customer, a supplier and themselves to review their performance and provide feedback on where improvements could be made. This review is then discussed with the member of staff's nearest leader. This system is intednded to reinforce the concept of responsible team work and of self management and improvement. It is also intended to avoid leaders being seen as 'god' in judgement over people but rather in a support and advisory role.

This open style principle of management is also reflected in their approach to the layout of the factory and offices with an open plan system and a single status organization. The high emphasis placed on communication is illustrated by their use of a 'rack up' meeting every morning with team members to discuss production, safety, quality, people, visitors and any other business.

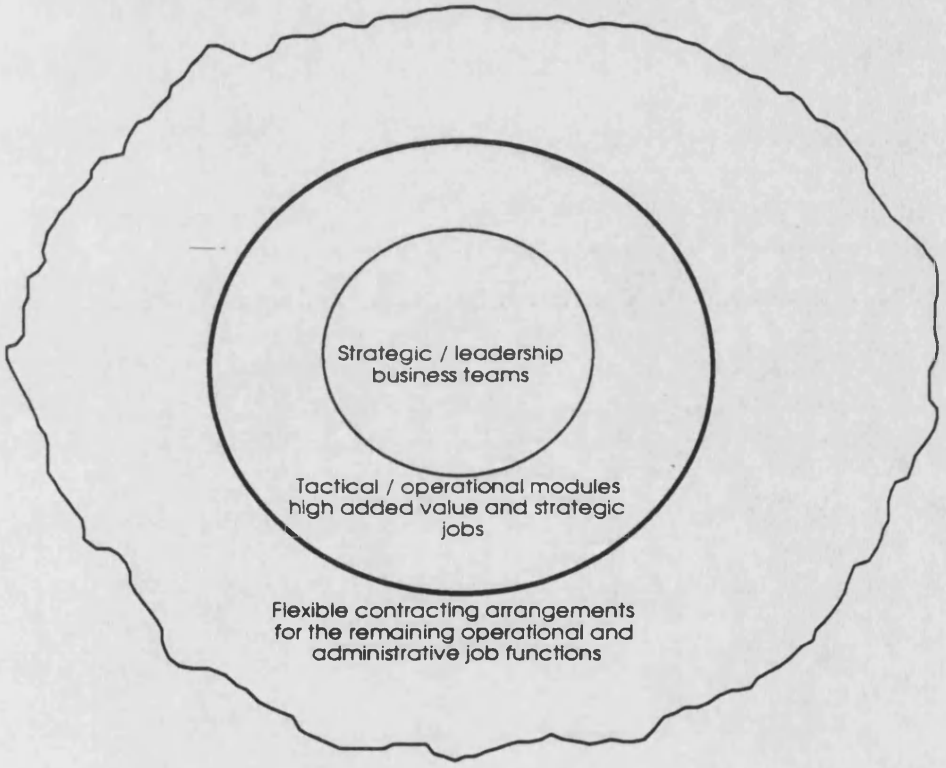
This style of management clearly also influences other factors and characteristics such as structure, work organization and personnel policies but, in particular, it influences the approach adopted to change and the introduction of new technology. This is illustrated in their approach to developing an automated system of quality control where a high level of involvement of the staff in the concept of quality and how this can best be achieved has been adopted. In this situation the automated system of quality feedback information are seen as enhancing the ability of staff and team members to take independent action to avoid and overcome problems and to achieve the objectives sought.

Thus, overall, the intended concept is one of self management allowing the people doing the job to run the plant and take the necessary operational decisions, relieving the leaders and the business team to concentrate on the strategic issues and the development of the business.

Organizational structure

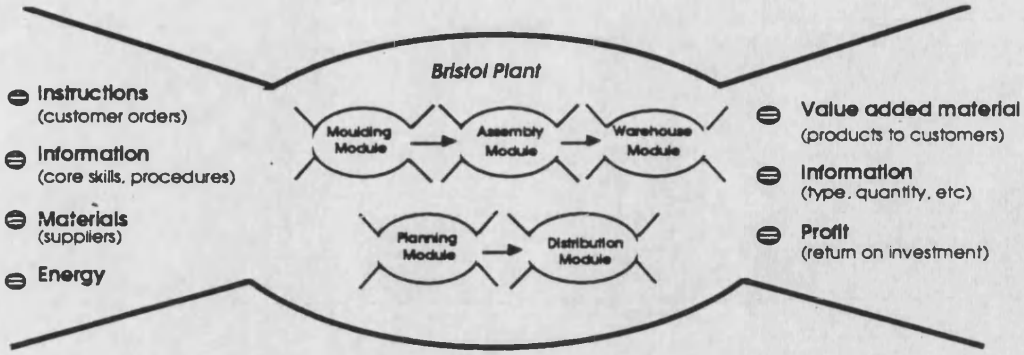
The company has consciously tried to develop a non-traditional organizational structure in the belief that this will lead to a more efficient and profitable operation. Thus, emphasis on hierarchy, formality and independent management control is minimised, the aim being to maximise responsibility flexibility and autonomous control. The intention is of a low fixed cost and more flexible structure, utilising high spans of managerial control and self managing team concepts (see Figure 34 below)

Figure 34 Organizational approach



The focal points of the organization are the core modules of moulding, assembly, warehouse, planning and distribution. Each of these modules is intended to be a semi-autonomous business area and is the responsibility of an identified self management team (see Figure 35 over). The object is for each team to be no bigger than 'eye or ear contact', understand their internal customer/supplier requirements and have a clear association with their module needs. The teams should 'own' their plant and run the daily operation with absolute flexibility between skill lines.

Figure 35 Example of process modules



Management in this situation is seen in a more collegiate/professional role, providing advice, guidance and encouragement and leadership from a strategic point of view.

Thus, their concept is consistent with open socio-technical principles with an emphasis on decentralization and autonomous business units. It tends towards a flatter, rather than hierarchical structure with high degrees of delegation, authority and autonomy at the operating level.

The inherent flexibility of the more organismic form of organization has also been enhanced by the concept of a flexible workforce with core and contract employees. These core employees are employed on the strategic high added-value tasks such as moulding and planning, using contract staff on a flexible basis for the remaining operational and administration tasks. The opportunity is also taken to sub-contract out low added value non-strategic aspects of manufacture.

Job design and work organization

The move towards greater automation in manufacturing brings many functional engineering operations much closer to the nature of the continuous operations associated with chemical and other process industries. This creates changes in the skills required from manual to more discretionary skills but also provides the opportunity for greater involvement of the staff in the management of the operations

themselves. Group technology may require group forms of organization providing a flatter, more flexible and cost effective structure in which the employees themselves take over the responsibilities carried out by the supervisor in the conventional organization.

This case study illustrates the opportunities afforded, when working with new technology, for choices and alternative approches to job design and work organization. In what is essentially a socio-technical system, Dupont have sought to place as much emphasis on the design of the work organization and on the involvement of the staff as they have on the technology and production processes concerned.

It is the company's stated objective to provide people with interesting jobs and an environment in which people enjoy their work. By 'aiming for a high span of control' and developing the 'self management' concepts, their aim is to develop a spirit of team work and to achieve high levels of quality and productivity.

While the goals are set for the teams, it is intended that responsibility for planning and organization of the work should be delegated fully to the group and shared by team members on a rotation basis. Thus, decisions on shifts,overtime, resources and responsibility is taken by the team members. Team representatives report daily at the 'rack up' meetings on products, performances and problems, personnel safety and quality issues and team members also participate in the selection process for new staff.

The objective of the self management approach to work organization is to achieve a situation in which staff have a greater knowledge of and responsibility for the products, the process and the customer requirements. They should be able to exercise and develop a greater variety of skills than in a conventional specialised job and structure. The company believes that these factors, combined with the trust that their style of management implies, should help to develop positive attitudes towards the company and to the customers and help to achieve the company's stated core belief, namely:

"Treat people as if they were what they ought to be and you help them become what they are capable of being."

Systems development

This emphasis and orientation towards people and their importance to business success appears to influence Dupont's approach to introducing new technology. The development of their systems of automation and information are characterized by high levels of involvement of the staff concerned at all stages of the process. This is illustrated in their approach to the introduction of statistical process control where this is seen as part of the development of total quality management. This places as much emphas is on the attitudes of staff to quality as on an automated system of quality feedback and information. Thus, in working towards more effective quality standards and performance the company has adopted a more integrated approach seeking to develop the technology, the information, the people and the organization to work towards the new goal. Initiatives have been taken to set up consultative committees, e.g. "Continuous Improvement Committee" in which staff are encouraged to suggest what their own concept of quality is and how this can best be achieved. In these circumstances new technology and computer based systems of manufacture and information appears to be less of a threat and more as a strength to peoples' "elbow" in achieving the levels of quality and productivity sought. The company feel that their flexible staffing policy and employment of contractors, helps to avoid drastic reductions in labour often associated with this type of change.

Personnel policies

It would obviously be inconsistent with their stated beliefs and objectives regarding people to employ divisive personnel policies regarding rewards and other conditions of employment. Reference has already been made to the system of peer assessment recently introduced and also to the selection procedure. However, beyond this, all employees are on the salary role and conditions are harmonised. The open plan offices and style of management is intended to make the leaders more visible and accessible and therefore to reduce the hierarchical element and differences in status. The company places an exceptionally high level of importance on safety for

its staff, for example, people have to pass a company driving test before being allowed to drive on company business.

Training for staff is provided on a wide basis and many aspects such as organizational effectiveness and training in interpersonal relationships often reserved for management personnel, are provided for all members of the self management teams.

Finally, no trade unions are officially recognised on the site, the intention being that the level of communication and consultation with staff should ensure that good employee relations are maintained.

Clearly, a number of these policies were quite controversial and in some ways smack of paternalism and wanting to keep the unions out. How effective these policies are and what employee reactions are to them is explored more fully in the following chapter.

CHAPTER 15 - EMPLOYEE REACTION TO THE BRISTOL WAY

Having studied the Company's approach and its attempts to develop a new culture and a 'different way of operating' I had been interested to establish employees reactions and how far their intentions worked out in practice. Certain members of the business team felt that while these were desirable objectives there were some some problems, particularly in relation to what they described as self management and team work. They were, therefore, very interested in the idea of a survey amongst the self managing teams to see how far the concepts incorporated in the 'Bristol Way' were working out in practice. They were concerned that the motivation and commitment to the ideas did not always materialize in practice.

I was therefore invited to carry out a survey to look at the issues and provide information for the business team to enable them to continue the development of the 'Bristol Way' and self management and team work in particular. This, I felt was consistent with their concept of continuous improvement and would help to establish how far their intentions had been incorporated into the actual culture of the organization.

Working environment and factory layout

The company's concept of an open and equal corporate culture is reflected in the style of the factory and the physical working environment. I was immediately struck by its comparative cleanliness and the feeling of light and spaciousness. The offices are based on a modular open plan system and it is as easy for someone to walk into and through the plant manager's office as anywhere else. Apart from this, the offices are arranged around the self managing teams and their open design appears to encourage group interaction.

On the shop floor great emphasis is laid on safety and the wearing of safety shoes and glasses. The work areas are clean and bright and are similarly organized around the self managing teams. There are no offices as such on the shop floor and the technicians move readily amongst the operators.

Although there are communal eating areas, there is still a clear physical distinction between the offices and the shop floor due, it is suggested, largely to the problem of noise from the wire cutting machines. This seemed to me to be the only negative factor in what was a generally pleasant working environment for all concerned.

The survey

In planning my approach to the survey I was conscious of the importance of taking a socio-technical system perspective. These ideas and the fact that as much effort should be devoted to the analysis and development of the social structure as to that of the task and technology were well received by the members of the business team. Similarly, I was anxious to incorporate objective measures in relation to their approach to job design and work organization. How far, for example, in the development of their concepts of self management and teamwork were the goals and desirable characteristics of job design achieved? With the agreement of the businesss team, I planned to use the Hackman and Oldham job diagnostic survey to collect data on these issues. Finally, I was also influenced by some of the more recent research in the development of high performance and work teams (Buchanan & Boddy 1985) which have been employed in high technology companies and which Dupont have been using apparently to good effect at the Maydown Plant in Northern Ireland. From these ideas and the discussion with the Business team, I suggested that it was necessary to operationalise the Bristol Way and establish a set of objectives for the development of effective self management and team work (see Figure 39, page 211).

At a meeting of the business team about the survey, these objectives were discussed and there was unanimous agreement that this was the ideal situation that they should seek to achieve.

The object of the survey therefore was to obtain data which would enable the company to review the 'Bristol Way; as a way of operating by measuring progress against these goals. This would then help to provide them with a path forward for its better achievement. The survey would analyse how far in practice their approach to management and organization meet the needs of the company and their stated objectives, but also the needs and the expectations of employees and all those involved.

Self management and team work in practice

I wrote a report that concluded while considerable progress has been made in developing this new culture and way of working, the company expected there to be are a number of needs and opportunities for improvement.

The detailed results of the survey and subsequent analysis have been fed back to each self managing team and they have endorsed the survey findings. These findings have also been fed back to the leaders for each self managing team. My report to the company on self management and team work at Yate is now presented in full in the following section.

REVIEW OF SELF MANAGEMENT AND TEAMWORK - MAY 1989

Purpose of Report

Following my 'Interim Report' dated October 1988 (p. 211) this report summarises the results of the survey on Self Management and Teamwork at Yate. It examines the application of the Company's corporate culture and how the 'Bristol Way' is working out in practice. It examines the nature of self management and teamwork and how far people feel involved and committed to its aims. Finally, it suggests opportunities for improvement and for building on current progress to achieve commitment to increased effectiveness.

Background to Survey

The Company and all those working at Yate has much to be proud of in the imaginative approach adopted to managing the business and its people. The 'Bristol Way' puts a premium on the involvement of people as the most effective way of achieving Quality and Customer Service. This commitment and the resultant style of management and organization contrasts dramatically with conventional approaches in other industries and organizations, and apart from being more enlightened clearly provides the Company with a strategic advantage.

However, all are only too ready to admit that ideally, though this may be as a goal, in practice it is often quite difficult to achieve and people can easily slip back into more conventional attitudes and modes of operation. The 'Bristol Way' and all that it implies requires effort and energy to make it work effectively. However, this investment of time in people and their development more than pays for itself in terms of increased motivation, flexibility and commitment to the business, its goals and continued effectiveness.

Having achieved so much there is nevertheless much improvement that can be made and the object of this report is to identify where investment and opportunities lie in order to ensure the 'Bristol Way' does work out in practice and that we can build on it in the future.

Objectives and Structure of Survey

The objectives and structure of the survey were set out in my Interim Report. In addition the report included a summary of initial findings presented at the 'Bristol Way Review' Workshop at the Grange in July 1988 and further findings and feedback at the two day workshop at the Stakis Hotel in October 1988.

Since then a detailed summary of the findings for each Self Management team has been prepared and fed back to the relevant leaders in the business teams.

The object of this report is therefore to summarise the key points of common concern regarding the development of Self Management and Teamwork and identify the areas in which the Business Team and individual leaders may wish to take action.

Initial/Overall Impressions

Before examining the more detailed aspects of involvement, self management and teamwork, it may be useful to comment on some of my initial and overall impressions during the survey. While these have been mentioned at the review workshops in July and October 1988 they still apply:

i. Contract Staff - In many sections there appears to be a marked contrast between the amount of involvement experienced by the Contract Staff as opposed to Technicians and other employees. This applies more to manufacturing than the service functions where often there seems to be little difference. However, even in some manufacturing sections contractors are experiencing a high level of involvement and apart from the job security factors there appears to be no inherent reason why contractorsshould not be treated as responsible people who want to be involved.

ii. Technicians - By contrast the Technicians are heavily involved if not overloaded. Many accept very high levels of responsibility and are often overstretched. While this can be satisfying to them as individuals, it often means that they are frustrated and because of assumptions regarding the

potential contribution from contractors are either unable or failing to delegate adequately. Indeed, there appears to be confusion in the minds of many Technicians as to what their role should be and whether they should be Technicians or Supervisors.

iii. Team - composition - For these reasons there is some doubt as to whether the contractors are members of the team. There may be team work between the Technicians but the Contractors on whom they depend do not feel a part of it. In addition there are some questions as to whether the right people are in the team in that the service people on whom the team virtually depend are in separate teams of their own, sometimes with their own objectives.

iv. Organization structure - This does throw up the question of the existing organization structure and in particular the divisions between the office and the shop floor. When each is so vitally dependent on the other it brings the question to whether this is the appropriate structure. The existence of 'the wall' only serves to accentuate the problems.

v. Motivation and Feedback - Partly perhaps because few people are able to see the whole job through feedback tends to suffer. For motivation it is essential for people to obtain feedback on their efforts either through from the job itself or from other people, e.g. colleague, customers or senior staff. Too often neither situation applies and this inevitably effects satisfaction, motivation and morale.

vi. Leaders Role - This inevitably raises the question of the role of the Leaders and how they are spending their time. From the lack of feedback received there is some suggestion that leaders may confuse the need for"delegation with abdication" and the idea that self management means leaving people alone to get on with it.

However again, perhaps as a consequence of the above, there is some evidence that Leaders are becoming too involved in the day to day operational problems

of the teams which prevents them from concentrating sufficiently on the more developmental strategic aspects of their role.

vii. Other factors - other factors noted during the survey were:

- the question of career progression and further development for the Technicians.
- the ratio of contract staff to employees and whether it was possible to offer more permanent posts.
- whether people are involved at the level of the business.

Self Management and Team Work

The notion of self management and teamwork implies that individuals and groups of people at work should be capable of planning and organizing their own work without the necessity of direct supervision. It rests on the assumption that given the right circumstances, people can be motivated to achieve objectives which they are committed to and can obtain satisfaction and reward from their achievement. This in practice is a reflection of the basic principle of the 'Bristol Way' namely :

'Treat people as if they were what they ought to be and you help them to become what they are capable of being!'

Clearly, this implies trust and confidence in people's ability and maturity to act responsibly and in their potential for growth and development. It has clear implications for the culture of the organization and for the style of leadership required.

However, people can only act responsibly and plan and organise their own work if they know what they are trying to achieve and whether or not they are being successful. So while providing people with scope and direction they need objectives and feedback on their achievement. For effective self management and teamwork people need:

i. A clear and meaningful goal which they can identify with.

i. A clear and meaningful goal which they can identify with.

ii. Scope and discretion to plan and organize their own work towards these goals.

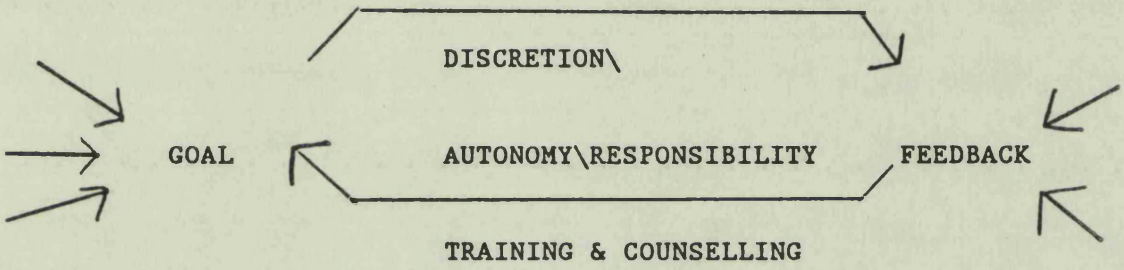
iii. Direct and meaningful feedback as individuals and as a team on their achievement.

It is the clear role of the Leaders to provide these conditions.

Figure 36 Conditions for Self Management and Teamwork

GOAL\IDEA - Depends on people's ABILITY, MOTIVATION
- asking them to PLAN\ORGANISE OWN WORK

INDIVIDUALS AND TEAMS NEED



Levels of involvement and motivation

A detailed analysis of the level of involvement and satisfaction has been provided for the Leaders of each self managing team from analysis of the completed questionnaires , and of the group discussions in the survey. This questionnaire taps peoples reactions to a number of key variables related to their motivation and involvement in their work . However, while the situation will obviously vary from one section to another a number of general observations can be made.

Figure 37 Key Motivational Job Characteristics

Key motivational job characteristics

Variety	The variety afforded by the job in terms of activity or skills required
Task Identity	A sense of doing a whole job from beginning to end with a visible outcome
Task Significance	The perceived impact of the job on the lives of work of other people
Autonomy	The degree of freedom, independence and discretion in planning and organising their own work
Feedback	The extent to which the job provides feedback on the effectiveness of their own performance

Other factors affecting sense of involvement and satisfaction

Dealing with others	Degree of involvement with others and sense of team work
Feedback from others	Feedback and support received from supervision and others

Goals and feedback

While most people believe that their jobs are very important (see scores on Task Significance) there is much less certainty about the goals that they should be trying to achieve. Where there are clear goals these are often simply in terms of output and the other important goals such as Quality, Safety, Cost Effectiveness and Morale are often absent.

Also because for many people they are only 'a cog on the wheel' and they perform only one part of the total job, the goal or objectives are not very meaningful (see score on Task Identity).

This lack of clear goals is also reflected in an absence of feedback both from the job itself but also in particular from the leaders. People often feel that the only feedback they get is when something goes wrong. The daily rack up meetings are more 'feed in' than 'feedback' and are simply reporting and recording production figures. Often information about other important goals such as efficiency come much too late and overall it is

The question of lack of feedback seems to be an almost universal problem and gives people the feeling that their work is neither understood or appreciated.

Variety and involvement in whole task

While sections sections such as Application Engineering and TAB enjoy high levels of variety and involvement in the total task, this decreases as one moves towards manufacturing. The service functions of Quality, Planning and Warehouse all experience a good deal of variety in their job but inevitably only feel involved in part of the process. When it comes to the production sections, such as Moulding and Cable Assemble they do feel that they see the job through and this is an important factor for their motivation. However, in many of the sections the work is monotonous and people would value a greater variety of tasks.

As mentioned earlier, this particularly applies to the Contractors who are often performing a single function which contrasts dramatically with the very varied role of the Technicians.

Autonomy and discretion

With the exception of the Contractors in some of the manufacturing sections, eg PA and Cable Assembly, most people experience a relatively high level of automony and discretion. The absence of a supervisor means that people are free to plan and organise their own work and this is very much appreciated. However, in some sections while the Technicians have a high level of autonomy themselves the Contractors 'under their control' feel that they are ordered about and told what to do. The only time they really feel involved in when there is a crisis and then everybody becomes part of the team.

However, despite the already high levels of involvement there is still an interest and willingness to take on additional responsibility particularly where these are meaningful and helpful towards the business goals such as for costs and budgets.

Teamwork and involvement with others

Generally, the level of teamwork experience is very high and people appreciate their contact and involvement with others. However, it was stressed that the concept of

teamwork applies more broadly than just the self managing teams and that groups working on projects as in Applications Engineering and Continuous Improvement need also to work as a team.

Some of the larger sections in Production seemed to consist of a number of smaller teams and this can lead to competition and conflict between these sections. Also there was some awareness amongst the Technicians of the need for greater 'interpersonal' and communication' skills.

The underlying issue, however, still applies on this question as to who should be involved in the team. There are some suggestions that the team should be more multi-disciplinary by nature so that everyone can feel that they have a meaningful contribution to make to the whole.

Leadership

The foregoing analysis does throw into clear relief the need for LEADERSHIP for the self managing teams. This inevitably raises questions about the role of the Technicians and indeed on the role of the Leaders themselves.

Technicians' role

A recent analysis of the Technicians role indicated that they had up to 13 separate responsibilities to carry out and that in an 8 hour day! Even if they were 'super human' which no doubt some of them are, this represents severe 'role over load' and for many role conflict as well. Their responsibility for technical and production aspects tend to conflict with the need for communications, training and counselling within the group, while those in sections with larger numbers of contract staff find themselves forced into a supervisory mould, planning and controlling other people's work in a traditional manner.

Clearly, more work needs to be done to clarify the most appropriate role for the Technicians to play and how the teams needs for Leadership is best provided.

Arguably the technical aspects and leadership role should not be performed by one and the same person and some may be better suited to one rather than the other.

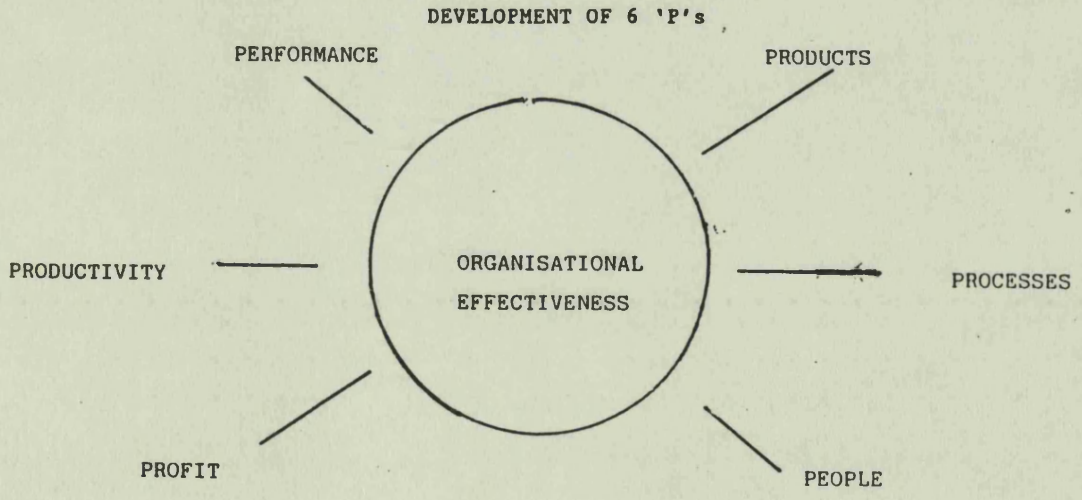
Leaders' role

A similar situation applies to some extent to the Leaders who again because of conflicting demands on their time may not always be able to devote the time required to overall leadership of the different self management teams. While it is not desirable for the Leaders to become involved in the detailed problems of their daily operation, it is vital that they help the teams to clarify their role and the objectives they should be achieving together with ensuring the provision of appropriate feedback and encouragement on goal achievement.

Apart from this, while the Technicians may have an important Operational Management role, the Leaders should arguably be free to concentrate on the more strategic and developmental aspects of the business and their teams.

It has been suggested that they plan to be responsible for the 6 'Ps', namely the development of Products, Processes, People, Performance, Productivity and Profits.

Figure 38 Strategic Role of Leaders



Thus, for example, the Leaders apart from helping people to clarify their goals and providing feedback on their performance, should provide advice, guidance, training and encouragement to team members and the Technicians in particular.

There is some question as to whether the Leaders are performing such a role and if they have the time to do so. This is no doubt partly a function of how clear they themselves are about their objectives and their part in the strategy and business plans for the company. It is possible that the Leaders could value help in analysing their own role and contribution to the business, and how more time could be created for carrying out this vital leadership task.

Communications

The survey indicated some concern over the effectiveness of communications. The rack up meetings are felt by many people to be a bit of a formality and while they provide feedback on performance they tend to be one way and do not really fulfil the communication needs of people in the team. While some teams have regular communication meetings to discuss problems and progress this is by no means universal and there may be a need for the Leaders to spend more time in communication with their teams.

Participation

While much effort is made to involve people at the level of the job there is some concern about involvement at the level of the business. How far do people feel involved in the plans and strategy of the business? Arguably we cannot expect people to take a great deal of responsibility for their own job if they do not have some say or influence in the developments within the business as a whole.

An Assessment

While much has clearly been achieved, in relation to the goals for Self Management and Teamwork agreed by the Business team , there is still considerable opportunity and need for improvement.

Goals for Self Management and Teamwork from Interim Report

Self Management and Teamwork

Aim to develop individuals and teams who identify with

- business goals and their contribution to them
- customers and give them good service
- product, its quality and cost effectiveness
- process from beginning to end
- team and have a meaningful contribution to it
- targets for performance, quality and costs and get feedback on their achievement.

Can we say, for example, that everyone identifies with the business goals and their contribution to them ? While there is a high level of customer orientation many people would like to get closer to the customer and are there not opportunities to improve on customer service and delivery performance ? While people may identify with the product are they committed to quality and can they be concerned about costs if they don't know what they are ? Also is it possible for people to identify with the process from the beginning to the end if they only complete one part of it ?

Do people (eg the Contractors) really feel part of the team and have a meaningful contribution to it ? Finally, can we really say that people have clear and meaningful targets in terms of performance, quality and costs and that they obtain feedback on their achievement !

It does appear that in all these areas there is room and opportunity for improvement. Certainly, as far as the staff are concerned (including the Contractors) there is a wish and a will to be further involved.

Path forward

The foregoing analysis suggests that the following areas and aspects could form elements in an agreed path forward for the 'Bristol Way' for improving Self Management and Teamwork in practice :

i. Goals and Feedback - Need to explore better provision of objectives and feedback to enable the teams to manage themselves more effectively.

ii. Variety - Need to explore ways of improving the variety in people's work, particularly amongst the Contractors, by involving them in other tasks.

iii. Involvement in whole - Where possible we should try to create jobs and teams who see the whole job through from customer order to delivery.

iv. Responsibility - Need to respond to peoples interest in taking greater responsibility for such things as costs and budgets

v. Teamwork - Need to look at composition of teams and whether right people are involved. Ideally, grouping those people who need to work together to give the customer the service or product they need. Need for team building not only within self managing teams but for cross site projects and activities.

vi. Technicians Role - Need to help Technicians clarify their role. How should they be using their time and what are their individual strengths and interests. How can we ease the load and spread involvement while maintaining the commitment of the Technicians. How can we best provide for the needs for leadership within the self managing team.

vi. Leaders - How can we help the leaders find the time for communication and Leadership for the teams? What things are Leaders doing now that they don't need to do? Can we help them develop their strategic role and the 6 'P's

viii. Communications - What part should Rack up play within the total communication systems? What part should the Leaders play in communications?

ix. Participation - How can we involve people more effectively in the business, its plans, objectives and strategy!

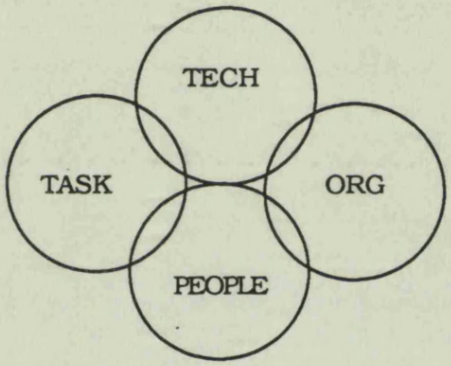
Interim report on Self Management and Team work

Introduction

Following my own interests in business efficiency and employee involvement, the Company invited me to help them develop the 'Bristol Way' in practice.

At a meeting with the Business Team on 23 May 1988 it was agreed that as part of the process of Continual Improvement there was a need to develop the concept of the 'Bristol Way' in practice particularly relating to Self Management and Team Work.

The notion of an organisation as a Socio/technical system reminded us of the need to put in as much effort to the development of People and the Organization as into the Task and Technology.



Objective

The overall objective, it was agreed, is to create the following situation in which individuals and teams identify with:

Figure 39 Self Management and Team Work

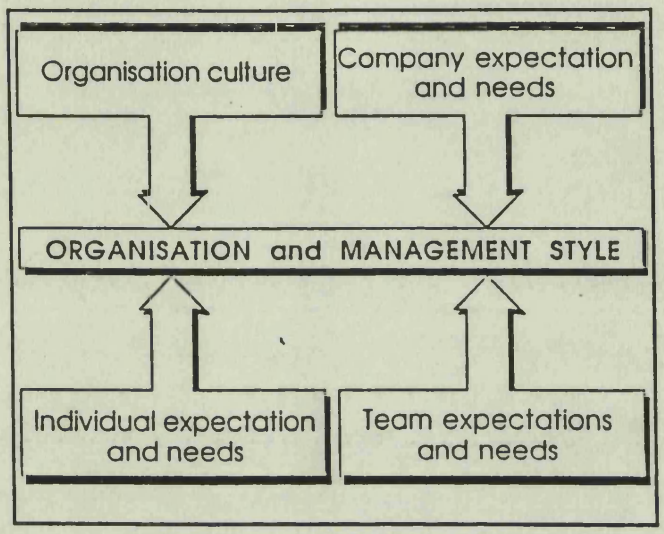
Aim to develop individuals and teams who identify with:

- business goals and their contribution to them
- customers and give them good service
- product, its quality and cost effectiveness
- process from beginning to end
- team and have a meaningful contribution to it
- targets for performance, quality and costs and get feedback on their achievement

Way Forward

It was agreed that the first step should be to establish how the 'Bristol Way' worked in practice,particularly relating to Self-Management and Teamwork at the level of the shop and office floor. How far are peoples' needs and expectations being fulfilled ? Does the current approach of organization and management style enable people to contribute to and fulfil the needs of the business.

Figure 40 Review of Needs and Expectations



Following this discussion it was agreed that the first step should be to hold discussions with a cross section of people from the Self Management Team by using a well tried and tested questionnaire to assess people's sense of involvement, motivation and satisfaction with their job and work situation in the Company. The results of this survey would be fed back to the participants and to members of the Business Team.

Results

Feedback of my initial impressions and the key issues which emerged from the survey was provided at the Business Team meeting at the Grange on Friday, 1 July. The overall issues (see Appendix 1) concern the site as a whole and refer to overall policy issues relating to the Bristol Way. A number of these issues have already been addressed, e.g. the question of Contract Staff and feedback has been provided by the leaders to the technicians on the points which have emerged.

More detailed feedback has also been provided to the Business Team at their 2 day Workshop on the Bristol Way on 6/7 October at the Stakis Hotel. This focused in particular on the concepts of Self Management and Teamwork and what this implies for Leadership (see Appendix II). The issues relating to the role of the technician and the leaders in particular were explored together with the development of Communication and Participation on the site.

A series of follow up meetings have been convened when members of the Business Team will work through these issues and initiate follow up action and developments.

Further Feedback

Further feedback will be provided in the form of an analysis of the results by each Section and Self managing Team. This data will be made available to the leaders and team members and will form the basis for a dialogue between the team and their leaders on how the objectives of Self Management and Teamwork can be achieved).

Way Forward

Following the above discussions will be held with individual members of the Business TEam on their role as Leaders and how Self Management and Teamwork apply in their situation.

I was invited to give some feedback on my first impressions from the survey at a workshop in June 1988. The Company hold regular meetings of the business team to review the Bristol Way and this was seen as a useful opportunity to provide some input to thie r discussions. The interim report is contained at the end document (p. 211). It showed that in several respects the ideals set out in the statement about the Bristol Way were not being fully achieved.

One very big issue related to the role and contribution of contract staff who, in many peoples' eyes, were being treated differently to permanent employees and yet, if the company depended heavily on contractors for completing the work, they could ill afford to have anything other than their complete involvement. This problem extended into the area of team work where, in many areas, the contractors did not feel part of the team. The technicians and full-time employees tended to take all the responsibility to the extent of being overloaded and therefore whilst experiencing frustration did achieve a lot of satisfaction, possibly at the expense of other people.

While harmonization may have existed in relation to terms and conditions of employment, and there were open plan offices, there was still a clear distinction between the shop and office floor. The existence of 'a wall' apparently to deaden the sound of machines, caused a definite feeling of us and them.

But possibly more importantly, these functional divisions appeared to place constraints on the degree of involvement and teamwork that was possible in practice and the existence of a separate planning and quality function, frequently meant that the self managing team was unable to take full responsibility for these aspects of their work.

This situation was further aggravated by apparent uncertainty relating to the roles of the technicians and leaders. The technicians, as their name implies, are better qualified in technical terms than in human and interpersonal skills. Others with large numbers of staff still tend towards a traditional supervisory role than providing effective leadership.

Similar problems occurred with the leaders who, often uncertain as to their role in relation to the self management team, tend to abdicate rather than delegate and to overlook their team leadership responsibilities.

These points were fully discussed at the review meeting and I felt they were well received and accepted by the members of the business team.

A further opportunity to provide feedback came at the next Bristol Way Workshop held in October 1988. On this occasion I was able to illustrate the results of the survey using the Hackman and Oldham survey (1980) in particular sections, namely moulding and product assembly (see Figures 40 & 41).

These contrasting results in these two sections showed that impact that job design, work organization, technology and the style of leadership can have on the relative degree of involvement and satisfaction of the people concerned. It also helped to emphasise what conditions were requried for effective self management and team work which were discussed as part of my presentation on this occasion. I introduced a model for effective self management and team work which emphasised the need for clear and meaningfull goals, autonomy and direction in planning and organizing the work and for meaningful feedback (see page 202). Clearly, however, people are only able to work this way if they have the necessary knowledge, attitudes and skills and this had clear implications for the role of leaders in creating these conditions. Thus, rather than directing and controlling in a conventional way, I suggested that the role of the leader was more to do with training and conselling the team and their members in how to work this way.

This then led to further discussion about the role of the leaders as members of the business team. I suggested that evidence from the survey indicated that the leaders were too involved in operational problems at the expense of the strategic development of the firm. This led to discussion of a possible model for the strategic role of the leaders (see page 206). I argued that if they had self managing business teams, who with the necessary technology, information and resources are capable of managing the ongoing operation then their role was a largely strategic role responsible

Figure 41 Product Assembly Analysis

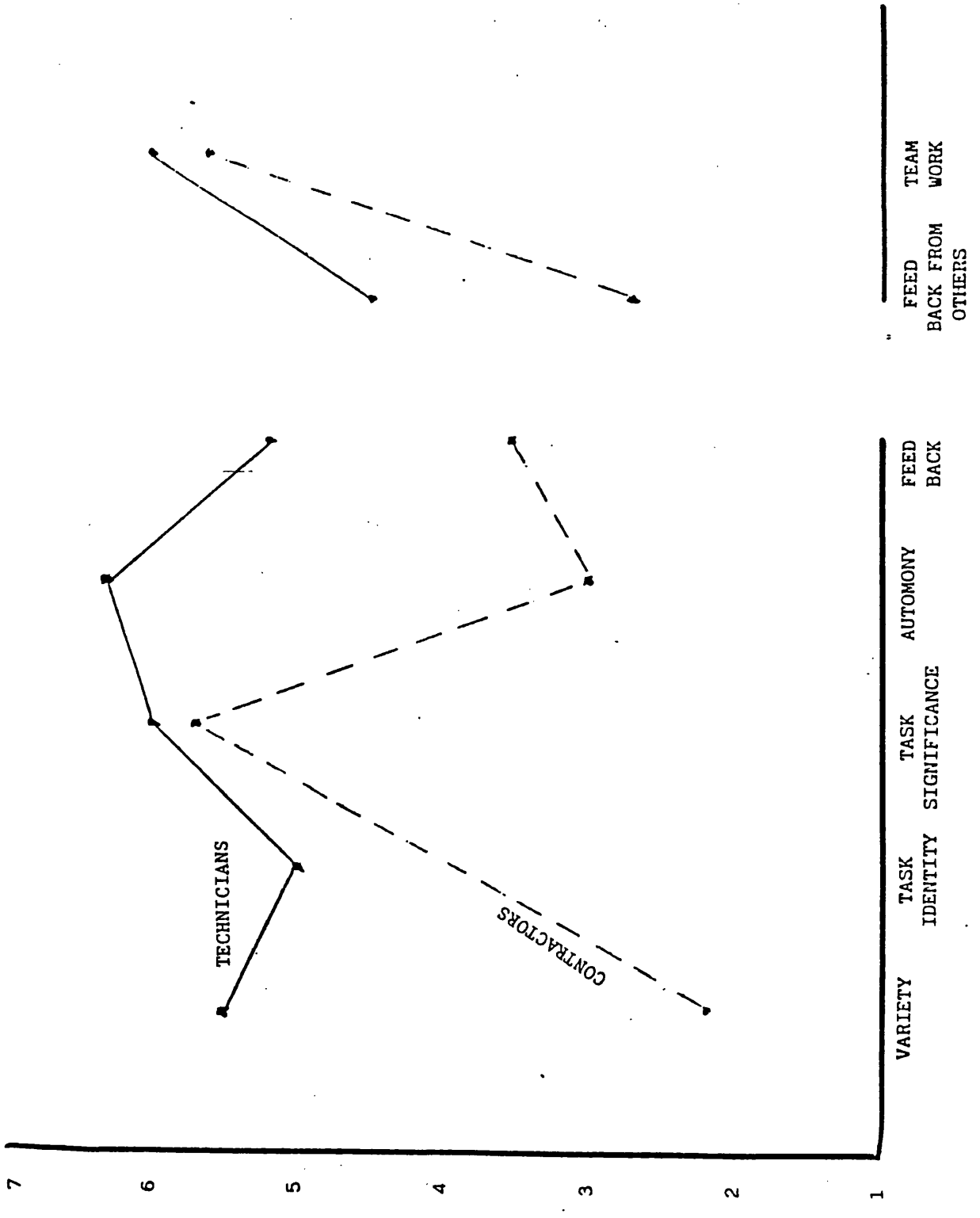
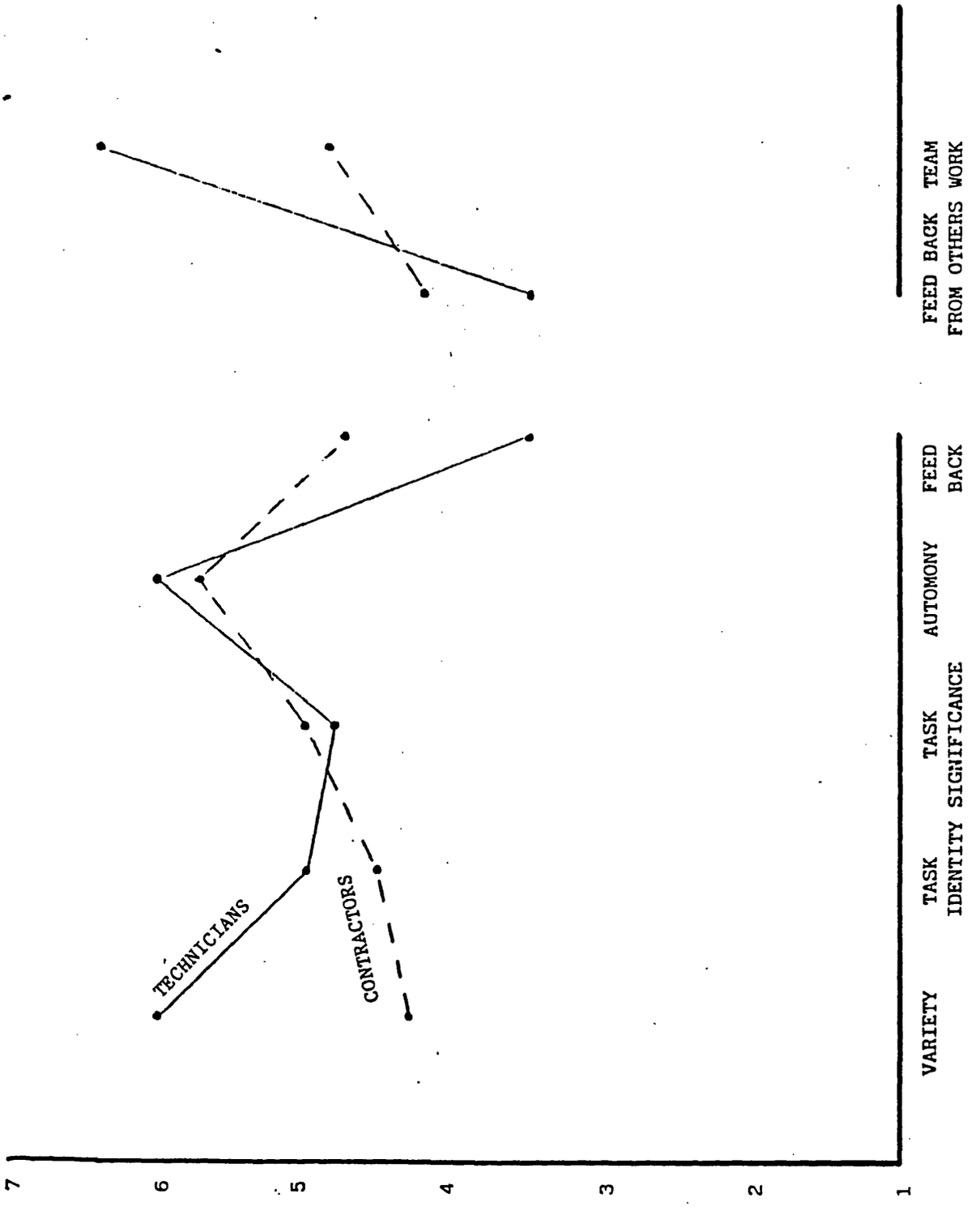


Figure 42 Moulding Analysis



for the strategic development of the six 'P's, namely people, processes, products, performances, productivity and profit. This clearly gave the business team food for thought, because the indications are that insufficient time has been devoted to the development of the leaders, their role and the business team as a team.

While the situation for each self managing team was obviously different, analysis of the overall results indicated a number of common trends. In particular, there was an evident need for clearer goals and more effective feedback for the self managing teams. Too often their goals were defined in output terms only and feedback only occurred if something went wrong.

Peoples' experience of variety, and being involved in the whole task varied considerably from one section to another, but those who were able to see the whole job through experienced much greater satisfaction in terms of variety and task identity.

The latter does have implications for another issue that which emerged in terms of team work and team composition. There were suggestions and indications that creating more multi-disciplinary teams responsible for all aspects including functions such as planning and quality control, might be more effective both in terms of peoples' motivation and commitment, but also in terms of the objectives the company is trying to achieve, namely improved competitiveness, quality standards and customer service.

My report concluded with an assessment of the extent to which the goals agreed for self management and team work had in fact been achieved. While progress had clearly been made it was fair to say that change and improvement was still required in each of the defined areas. This provided me with the opportunity to suggest the possible elements of a path forward in which the business team and the leaders, together with the members of the self managing team could explore the opportunitites for further change and development. In this way the concepts of the 'Bristol Way' and the culture the company was trying to create could be fully consolidated and absorbed into their daily operations.

These findings have been discussed with the site manager and a plan for feedback and follow-up of this work has been agreed. The focus of this work is around the need for improvements in goals and feedback for the teams, in the structure and compositon of the teams themselves and the role and responsibilities of the leaders.

Review of business team/Bristol Way

As part of the review and development of the Bristol Way, I was also asked to conduct a survey into the role and structure of the Business Team and of its individual leaders. From my earlier studies it had become evident that there was a need to help the individual leaders clarify their own roles and responsibilities, particularly relating to their development of self management and team work.

Therefore, as a further extention of my work with the Company, I carried out a survey within the eight members of the Business Team and a member of other key people who, it was felt, would have a useful contribution to make on this issue. The object of the review was to help the individual leaders review their contribution in the light of the changing environment in which the company was operating and to develop effective self management and team work amongst the Business Team.

The results of the survey, which are included as Appendix 4, , indicated that there was a need for the company to review both its strategy and its structure in the light of changing business conditions. This would involve the creation of a number of smaller more customary business units in which the leaders would take full responsibility for their operation and development. This implied a major change in the role of the Business Team and its members which would become more concerned with the strategic development of the firm rather than the day-to-day operational issues. It also impled a change in the role of the individual leaders who would now be responsible for all aspects of the operation of their 'business' and for the team and its development.

In summary, the report which was well received, has indicated a need for an integrated programme of strategic, organizational and leadership development. The first phase of implementation has taken place with the appointment of the leaders to their teams.

Development of Business Team

Following my work with the self managing teams it had been agreed at the outset of my involvement with the company that we should also include a review of the business team and the role of the leaders themselves. This intention plus changes in the business led the opportunity for me to review the role of the business team and its members. This report represents the latest stage of my work with the company and is very much concerned with the development of the strategy, structure and culture of the firm and is included as a stop press item.

REVIEW OF BUSINESS TEAM/BRISTOL WAY - SEPTEMBER 1989

Background to Review

A number of factors have combined to suggest that it would be timely and appropriate to conduct a review of the organisation at Bristol and of the role of the Business Team and its members. It had always been the intention as part of the Bristol Way review to follow up the discussions with the self managing teams with a similar exercise with the leaders. Indeed, my earlier report on Self Management and Teamwork indicated that changes in the role of the Business Team and the leaders were required.

However, apart from this other developments such as the arrival of EMD, the move to the new site and changes effecting the company's products and activities have all combined to create a felt need for change. This, together with Bob Jennings' appointment as the new site manager and completion of his first three months assessment of the company, created a useful opportunity to involve people in such a review.

Objectives:

The need for and objectives of the review were discussed with the members of the Business Team in July. A paper outlining the reason for the review, its aims, methods and the subjects to be discussed was circulated in advance to all those who participated. It was felt desirable that views should be sought not only from the existing members of the team, but other key people who had a perspective on these issues.

However, the important thing was to provide an opportunity for members of the Business Team to review their own role and contribution to the business, particularly in the light of the changing circumstances, the aim being to create a more effective organisation which satisfies the needs of both the business and the individuals concerned.

Method:

In the event, 12 individual discussions were held, eight with Business Team members and four with other key personnel. These discussions were held, in the main, off-site on the semi-structured basis over the summer period.

The discussions proved to be both stimulating and encouraging with a remarkably high degree of consensus on the issues involved. While people recognised that there were problems, there was a very positive attitude towards their solution and to the potential contribution that people could make to the development of the business. This report presents my impressions of the issues concerned and a summary of people's views on the development of the business and their contributions to it. I hope that the report will serve as a stimulus to further discussions and as a catalyst to the changes that people feel are required.

The Business

The first part of the review explored the issues around who Dupont at Yate are, what business they are in and how changes in the environment of the business affects the activity and its future.

The Concept:

When the company opened its new factory five years ago at Yate it was seen as an exciting opportunity to create the concept of a manufacturing business based on a different way of operating, involving the total co-operation of all those involved. As opposed to much of the traditional industry with its hierarchies, us and them attitudes, demarcation lines, and restrictive practices, the flatter, more fluid structure with its self managing teams was intended to provide both flexibility in operation and a sense of involvement and responsibility for the staff.

This has enabled the company to achieve a much more responsive system in terms of delivery performance with a commitment to customer service, quality and continuous improvement. These values are acknowledged and recognised not only within the plant but outside by other people within Dupont, in other industries and by the company's customers. It is, if anything, one of the Bristol site's major strengths in other people's eyes and one of the factors which people feel it is important to build on.

The existing business:

However, as is not untypical in the development of any business the Yate site was largely formed around the manufacture of a single product, namely Bergstick, part of Dupont's involvement in the interconnect business. Thus, the nature of the initial business was very much that of large scale manufacture of a relatively standardised component which was sold on the basis of quality, cost and delivery to the company's customers. This type of activity called for the development of specialised skills and resources such as industrial and product engineering, planning, cost control and quality in order to help manufacturing increase the efficiency of the operation. However the danger was that developing these functions and bringing in the specialist skills required can detract from the people doing the job and their feeling of involvement in the total task and responsibility for the end result. This, it is felt, can be further accentuated by physical barriers or differences in terms and conditions or treatment which can create the us and them feeling the firm has tried to avoid.

Again, as is not untypical, as the life cycle of this initial product extended other firms and producers have entered the market, creating more competition and a drive to reduce costs and margins. This has led to over capacity in the interconnect business and a situation in which Dupont at Bristol is becoming increasing uncompetitive in the long run component manufacturing business. Added to which the development of the automated plant SMAS has increased the cost base and made it more difficult for the company to compete against the smaller '*garage*' type producer.

Alongside these changes there has been an increasing development in the need for specialised short-order interconnect products which can either be sold as part of the company's provision in terms of systems and assembly or as a direct response to a

customer's need. While the scale of this business may not be so great it offers much higher profit margins and arguably matches the particular resources, facilities and expertise of the Bristol site more effectively than long run production business. The very nature of the Bristol site, with its flexibility, short lead times, versatile workforce and automated systems should, it is felt, enable the firm to capitalise on this new market and the business opportunity it presents.

Implications of Changes:

Clearly, such changes have important implications. Those involved in the interconnect business will, it is felt, need to get much closer to the customer. They will need to become more market orientated rather than production orientated. They will need to drive for still shorter lead/delivery times, together with high quality and low cost. Indeed, they will need to operate as a Business Team in their own right rather than just as a manufacturing facility.

There has been criticism of manufacturing and of the self managing teams and yet in many senses one wonders whether their problems are of their own making. The divorce of marketing and sales from the manufacturing unit and the people on which they depend cannot have helped communication and motivation. The fact that many of the resources on which manufacturing depends, eg planning, cost control, quality and production engineering, are not part of the manufacturing team further erodes their responsibility, involvement in the whole job, and opportunity to solve their own problems. If all you are expected to do is to get the goods out of the door and be blamed if you didn't do it or your costs are too high, may be it is not surprising that their morale, motivation and willingness to manage themselves has suffered!

Arguably, the rest of the site has much to thank. those involved in the manufacturing and the Bergstick operation for. They have provided the base and bread and butter for the business and have supplied people for other developments and activities. Now perhaps they should have the chance and opportunity to respond to the new challenges provided without the fetters and constraints of carrying the business as a whole.

New Business/Product Development:

With the changes occurring in the market for interconnectors it was recognised that something more should be done to encourage the development of new products. To this end an engineering group was created with the objective of identifying the needs and opportunity for new products, developing these and bringing them into production. This group, though skilled and very able as application and product engineers, found difficulty in both interpreting and fulfilling their brief. The lack of marketing and sales support and the fact that they were largely divorced from these functions and to a large extent the customer meant that they could not get in at the design stage with the customer to identify the need. This, and the other functional divisions on the site, caused frustration for the group and its leader, probably through no fault of their own, meant that the development in terms of new products did not really occur. When it did occur it was where the respective engineers got closer to the customer and the relevant product group as happened in Systems and Assembly. In fact this experience served as a model for further developments where Systems and Assembly now have their own dedicated applications engineer. Clearly the existing functional structure had not helped to facilitate new products, innovation and development!

Systems and Assembly:

These lessons have to quite a large extent influenced the approach adopted to the development of what now represents a significant additional area of business and activity for the company, namely Systems and Assembly. There is, it is felt, an increasing opportunity for the company to develop complete, high tech/black box systems solutions to a customer's need, employing both the firms expertise and to an extent its products.

It is felt by those involved that this activity builds on some of the unique strengths that the company offers. In particular, it builds on the firms interest and experience in application engineering, in manufacturing management, often employing external suppliers who need to work to company JIT and Quality requirements. It also utilises the company's prototype facilities and ability to provide first-off production products.

However, as with the changes in the Bergstick interconnect business, these developments also have similar implications in that to be effective the group increasingly needs access to its own resources in order to give the response required. Closeness to the customer, total involvement and seeing the job through are the order of the day and teamwork with strong leadership is the way people see it being accomplished.

TAB:

This feeling of the need for independence and autonomy of action seems to feature even more strongly when it comes to TAB. TAB which at this stage is more of a longer term research and development project than of a production activity does not appear to utilise or draw on any of the traditional facilities or skills of the site. Indeed, the group have appeared to be somewhat isolationist not wishing to get too drawn in to the general issues and operations of the site.

Apart from requiring its own facilities, TAB is largely dealing with new and different customers. While many of the customers are in the same firm as those of the other groups, TAB is dealing with different people and on different problems.

It therefore makes little sense to those involved to be required to attend things like rack-up or cost meetings since their agenda and issues do not seem to be relevant to the problems of the TAB group. They've got a job to do and feel they need to be left to get on with it.

EMD:

A further major development has also occurred with the decision to transfer the EMD activity from Stevenage to the new Bristol site. This activity, which again relies on a different technology and manufacturing facilities, is by contrast an established business with its own traditions and personnel. The issue here therefore is not so much about the development of their business as their relationship with the existing activities on the Bristol site and the degree of interaction and integration with the people and the organisation concerned.

Summary:

An analysis of the business, who the company are, what business they are in and how changes are affecting them shows a number of significant changes. While the company was initially established as a manufacturing unit largely around the production of a single product, competition, customer demands and technical innovation both in terms of products and processes have drastically changed the situation.

We are now increasingly looking at a company composed of a number of separate but related product/market areas, each of which can increasingly be seen as a business in their own right, the only common feature being that they are all broadly in the electronics business, often serving different customers in the same firms and ultimately all occupying the same site. It represents a marked shift from a production orientated manufacturing unit to a customer centred, market
orientated, multi-business site.

This clearly has major implications for the structure and organisation of the business and for the role of the Business Team and its leaders.

Business Team

The next issue explored in the discussions was the role of the Business Team and how this might need to change in the light of the changing situation in the Business.

People were, in general, quite critical about the Business Team in the past. There was the feeling that it was rather weak and had never been properly organised with members being uncertain of their role. It tended to be introverted and preoccupied with fire fighting and operational problems. Meetings often get out of hand and discussions could be inconclusive. Also, while there was no overt conflict,personal ambitions tended to undermine the need to work together.

There was a strong feeling expressed of the need for the Business Team to become more action orientated, looking forward to where future business was coming from. There was a need for the team to develop a more business orientated perspective and look upwards and outwards rather than inwards. The team should share their experiences

and successes and be more mutually supportive, understanding each other's role and objectives.

People were conscious of the fact that they needed to create the right environment in which people could succeed and in this sense the Business Team and the leadership its provided is the key to the future of the site. Their ability to fulfil this role is, to some extent, a *'make or break'* situation for the future of the business.

Business Strategy:

One of the biggest problems for the Business Team was the fact that there were no clear business or corporate goals. There was, it is felt, no clear strategy for the business or, if there is, it is not properly communicated. While many of the business directions come from outside the site, eg from Geneva and USA, there is a need for an overall strategy linking all the aspects of the Electronics Division and creating a vision and some sort of corporate identity. As things stand the company has a low profile in the *'street'* and it is important to emphasise its identity as a centre of electronics and its belief in the *'Bristol Way'*. Its mission could perhaps be seen as the development of new products and processes for the electronics division, based on the development of flexible and competent team.

Integration and Differentiation:

However, the recent changes and developments in the business raised question in peoples' minds about the feasibility of establishing a common mission and strategy for the site. The trend and developments are very much towards the formation of discrete and separate products/market areas which will increasingly form their own business units and business teams. In this situation, we discussed what role the Business Team could have and what common issues and values they could share?

From a business point of view it was felt that there could be considerable value from a marketing point of view for customers to see an integrated electronics unit. In this sense, the creation of an electronics division with an identifiable corporate image and mission statement would show people what Dupont were offering and provide a competitive marketing tool.

Corporate Culture/Identity:

However, it was also felt that there are and should be areas of common concern about the way we run the business. These issues reflect the values that people hold and wish to project both internally and externally. For example, putting the customer first, a commitment to quality and the concept of continuous improvement, a belief in people and the contribution they can make and a professionalism in its engineering approach could represent values to which the business units and its members could subscribe. Thus, a strategy for the business would not only be about the development of products, processes, productivity and profits, but also about principles, policies, and people and professionalism.

Strategy Development:

The above analysis clearly points to strategy and the strategic development of the business as the key role for the future Business Team. In the new situation the business units will increasingly take responsibility for the day to day management of their operations. While the other members of the Business Team will want to share information on their progress, problems and plans, each team will be accountable for its own operations and its contribution to the strategic development of the business. In this sense they will be autonomous business units and self managing teams in the fullest sense of the word.

However, apart from the contribution of the business units to the company's strategic development, any strategy should, it is felt, include a contribution from the other aspects of the business that people felt vital to successful corporate development. Thus, aspects such as marketing customer service, quality/continuous improvement, people and their development and engineering professionalism should be represented. Strategy and its development should be seen as a process and not necessarily the prerogative of any one group in the company. Everybody in some senses has a contribution to make to its development and certainly all need to be orientated to its fulfilment. Thus, while the Business Team may need to ensure that this process is carried out, they will need to provide for input from other people from within and without the site. Clearly this means that apart from all the business units being represented, including EMD, it is vital that a marketing perspective is included in the process of strategy development.

Summary:

As can be seen from the foregoing analysis, there is a strong feeling that the role of the Business Team needs to change. Rather than being concerned with the operational aspects of the site, it should become more concerned with the development of the business. Its role should be one of planning and furthering the company's strategic development in all aspects of the business and of providing the direction and supportive climate in which the operating units can thrive.

Organisation

Any organisation is a means to an end rather than an end in itself! The organisation at Dupont therefore should be designed to fulfil the strategy, mission and goals that people have identified as important. This should govern the shape and style of organisation and influence the allocation of resources.

From the earlier discussion it is evident that the company is entering into a further stage of organisational development. This phase indicates a move from a functional structure based on specialisation and centralisation of control to a more decentralised structure with greater flexibility and delegation of authority.

Decentralisation:

Opinions expressed during the review on what form of organisation would be appropriate to the new situation reinforced this process of organisational development. Namely, that the company should be organised into smaller autonomous units, each with the resources and skills they need to fulfil their mission. These would increasingly been seen as individual business, justified on their own merits. They would be based on a multi-discipline team concept providing ownership, resources and decision making. In fact there needs to be a Business Team concept for each unit.

Corporate Services:

This clearly raised the question of how far the decentralisation process should go? While each business area felt that they needed their own specialised skills and resources, it was acknowledged that there could be difficulty in supporting this on a full-time basis.

This led to the identification of a number of common corporate services whose role would be to support the business units in their activities. These services could include such aspects as planning, quality, personnel, process engineering, finance and inventory control, data processing and distribution.

Matrix Structure:

It was felt that this should lead to a more fluid form of organisation based on individuals and what they can contribute to the various teams. In practice, this could take the form of a matrix structure in which the power and autonomy of the leaders of the business units was balanced by the influence and authority of those responsible for corporate services. Thus, for example, the demands on individuals in terms of business development would be balanced by a concern for their personal and career development.

Organisational Effectiveness:

In terms of change, rather than in drastic restructuring, the feeling was one of a continued process of organisational development to ensu reorganisational effectiveness (OE) in the new circumstances. This, it seems, means building on peoples' strengths and on the opportunities identified and working together to overcome any weakness that may emerge. In this respect, it is felt that greater use could be made of the OE expertise and experience available on the site to improve the effectiveness of the organisation and its processes.

Role of Leaders

With the exception of those members of the Business Team who had their own clearly defined business area to develop, there was some evidence of a loss of direction and degree of despondency amongst the members of the team with their existing situation. However, without exception all seem to be particularly committed to the company and keen to make a more effective contribution. The difficulties when they have occurred seem to stem more from a lack of direction and uncertainty as to which priorities to follow than any lack of interest or ability on the members' part. As with any of the self managing teams, the leaders as individuals and as a Business Team can only be motivated if:

a) they are clear about what they are trying to achieve and have what seems a worthwhile and meaningful objective

b) they have the resources, skills, discretion and authority to do what is required

c) they get rapid, useful and meaningful feedback on how they are doing in order to take corrective action and reinforce their motivation to the goal.

If these conditions apply not only will people be motivated but they will derive a good deal of satisfaction as well.

However, this situation does not appear to apply to a number of the Business Team members and they can therefore hardly be blamed if at times their motivation and enthusiasm waivers. The involvement of the team and its members in developing a strategy for the site and of their individual contribution to it could do much to overcome this problem.

But what contribution can the leaders make to the business and its development? As things are at present it is clear that apart from those exceptions already mentioned the majority of members do not feel they are able to make the sort of contribution that they are capable of. Too much concern and involvement in operational/day-to-day problems means that people are working too long for too little effect. The self managing teams are not managing themselves as well as they should and are also dependent on their leaders for decision making and problem solving. The functional structure of the organisation and the fact that the self managing teams do not have all the resources and skills they need to do the whole job, aggravates this situation and inevitably means that they have to refer elsewhere for help and guidance.

Leadership Development:

In the new situation it is essential that this problem is overcome if the business is to develop successfully. Reorganisation into smaller autonomous multi-disciplined business teams should help to ensure that the motivational condtions referred to above

apply. In this situation the people doing the job should have a clearer picture of what they are trying to achieve, should have the discretion to make the necessary decision and solve problems and with the provision of appropriate control information should know how they are doing. In these circumstances the role of the leader becomes one of providing direction, support and feedback to the teams in achieving their objectives. It calls, on the one hand, for direction and strong leadership, but on the other, support and encouragement to allow them to manage.

People recognise that not everyone is a good leader and that individuals may need training and support in working this way. Indeed, it was suggested that a part of the development of the '*Bristol Way*' some training in this way of working should be provided. In this respect the role of the site manager was acknowledged in providing counsell and support to the leaders in the development of their roles.

Strategic Contribution:

However, the other major contribution that the leaders feel they can make as members of the Business Team is in the strategic development of the business. This, in many respects, has been the '*missing*' element in peoples' jobs and a source of frustration to those concerned. Clearly each of the team members has particular strengths and interests which if time permitted they could develop for the benefit of the firm and the individual concerned. Typical of those strengths and interests are such aspects as total quality management, organisational effectiveness, world class manufacturing and the development of a manufacturing strategy. Clearly these are only examples of particular concepts and visions that interest and motivate people and members of the team and which, if they were given space and opportunity, could make a significant contribution to the business and its strategic development. Indeed, it may well be that the successful implementation of this type of concept is what sets Dupont apart from its competitors.

Thus, for example, providing those involved with the opportunity to pick up and develop the concept of a manufacturing strategy based the market and it needs could help to provide the catalyst and stimulus that the business and the individuals concerned need.

Bringing about the changes described requires not only a change in the organisation structure, but in people's attitudes and in particular amongst the leaders in the way they see their role and how they use their time. In this respect people were conscious of their own needs in terms of training and support to bring about the changes required.

Other Issues:

Although the discussions focussed on particular aspects of the business they were intentionally semi-structured in order to allow participants to raise issues that they considered relevant. As a consequence a number of other significant aspects were raised and discussed, which are summarised as follows:

- **'Bristol Way'** - although not specifically referred to, many of those involved raised the issue of the Bristol Way and its relevance to the changes occurring in the business. While people are conscious that it has been subject to some criticism, there is still a very strong commitment among existing staff to this concept as a way of running the business. While it should not be pushed too hard and certainly not imposed on anybody, people feel that it is still an '*experiment worth pursuing*' and indeed that it can provide a competitive edge.

Frequent changes of site managers, the failure to follow-up earlier reviews, the fact that the Business Team does not spend sufficient time improving its practice and the dilution of the team concept have all, to some extent, undermined its effectiveness.

However, despite these problems people appear to believe in the concept and that they should continue to work for it. If people don't work at it, it is felt a danger of losing it and of people being trampled over. As a concept, it encourages innovation and openness to change and if anything it makes even more sense in the new situation than in the past. The prospective link-up with EMD on the new site could provide the opportunity for a '*stepped*' improvement to be made in how the concept is applied in practice.

- **New Site** - this raises the question of the move to the new site about which there is a degree of disquiet and cynicism. The new site it is felt should provide a unique

opportunity for changing not only the physical location of the activities and people concerned but also for changing and improving the methods, processes, communication and organisational arrangements.

There is, however, a feeling that '*the tail is wagging the dog*' and, although considerable efforts have been made to involve people, it is simply transferring what already exists to a new location. This, people feel, if it occurs, is a missed opportunity. Although criteria have been agreed about the assumptions on which the new site should be based, eg open communications and lack of noise, the planning, it is felt by some, lacks a conceptual basis and is concentrating at too basic a level around things like drains and power supplies. Although circumstances may have dictated the situation, it appears to be a question of the business fitting into the new site rather than the new site fitting the needs of the business!

However, there is no disagreement amongst people about the opportunity that the move to the new site presents and the need for this to be more than just a physical move. It presents a unique opportunity to develop and project a distinct corporate identity to customers, to the community, to Dupont and indeed to present and prospective employees. If you don't have that common vision or identity as a group of people and as a site, then you have just got, as one participant so aptly suggested, '*a collection of tenants*'!

- **Manufacturing** - the role and future of manufacturing as a function on the site does seem to represent something of an issue. In its current form, people seem to be uncertain whether manufacturing is just a cost and a problem or an opportunity and a strength. Certainly, changes in the market and in technology have put ever increasing pressure on the existing function to reduce costs. This in itself has threatened quality standards and left people feeling like the poor relations.

And yet, people, processes and production are a potential source of profit and development and innovation in this area can help to secure the firms competitive position and long term survival.

In the new situation, where each business unit, including connectors could have its own resources, presumably including manufacturing the continued existence of it as a site function may be open to question. However, that there is potential for development, change and innovation in this area is beyond question and it is in this change of outlook towards manufacturing that the opportunities may lie. Working together to achieve world class manufacturing standards and the fulfilment of a market led manufacturing strategy would provide the path forward that those involved with manufacturing seek.

- **Training and Career Development** - one of the issues that emerged as significant during the discussion was the question of career development or the lack of it on the site. It was felt that there is some conflict between individual needs for career development within Dupont as a whole and the needs of the site. The problem of career development was particularly acute at technician level but also applied to members of the Business Team.

Many people were conscious of their need to develop their management skills which, for most people, had been learned on the job. There was a need for more interchange and with a flat structure the possibilities of job rotation to widen people's horizons should particularly be explored. As already mentioned, people were particularly conscious of the need for training in managing in a self managing way and for re-establishing priorities through the more effective management of time.

For many with essentially technical or professional backgrounds there is a recognised need for individuals to become more business orientated with a greater awareness of market, financial, political and human aspects. In this context, the idea of some form of joint development programme was discussed in which individuals would participate as members of the Business Team to the firms strategic development. At the same time however they could also further their own personal and career development by capitalising on the learning achieved and obtaining credits and a management qualification in the process.

Summary and Path Forward

Corporate Development

The foregoing review of the Business Team/Bristol Way has confirmed the need for the company and business team to embark on a process of strategic, organisational and leadership development. These aspects are inevitably linked as Figure 42 suggests.

The process could take the following stages:

Strategic Development

1. *Restatement by the Business Team of corporate identity, mission and objectives in the light of the review and the changing circumstances identified.*

   i.e. Who are we, what business/businesses are we/should we be in and what are we trying to achieve as a site.

   e.g. Mission statement - To become the centre for the development of new products and processes for the electronics division.

2. *What are the key opportunities for development in the business?*

   e.g. - developing a market lead/customer orientated service
   - opportunities for the development of new products/markets in Interconnect, S & A, TAB and EMD fields. (See Figure 43).

3. *How can we build on our existing strengths?*

   Capitalising on existing strengths (see Figure 44).

e.g.	Manufacturing	-	Development of a Manufacturing strategy
	Quality	-	Building on continuing Support concept
	Personnel	-	Development of the Bristol Way

4. *Need to develop a strategy and product portfolio that balances risk and return* (see Figure 45).

Organisational Development

5. *Define what new organisational structure will be required to fulfil the mission and identify the key roles and functions required.*

   e.g. the development of a matrix structure to optimise flexibility and decentralisation of responsibility (see Figure 46).

6. *Invite individuals to identify what contributions they believe they could make to the business and its strategic development.*

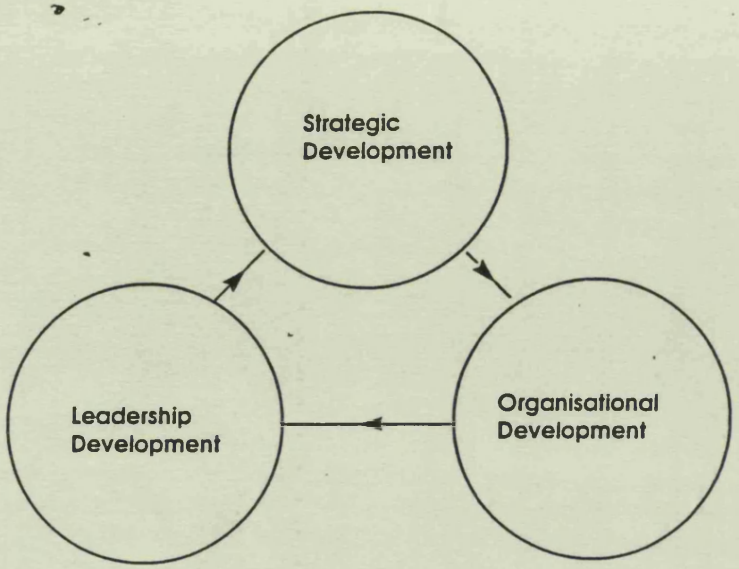
7. *Clarify and confirm the overall role of individual leaders and the resources required to achieve their objectives.*

Leadership Development

8. *Leaders clarify their own roles and priorities and how they can make the most effective use of their time,* i.e. 6 'p's. (see Figure 47).

9. *Leaders work with their own team to clarify their role; objectives and the contribution that they can make as a team to the strategic development of the business as a whole,*
   i.e. TEAM DEVELOPMENT.

10. *Identify individual leaders needs for development in terms of personnel, leadership and business skills and establishing programmes and profits to achieve this.*
    i.e. LEADER DEVELOPMENT



- Growth Matrix

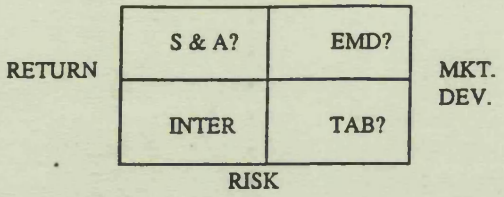
Mkt. Dev.	Prod. Dev.	
	More sales of existing products	New product to existing customers
	Existing products to new customers	New products to new customers

- SWOT Analysis

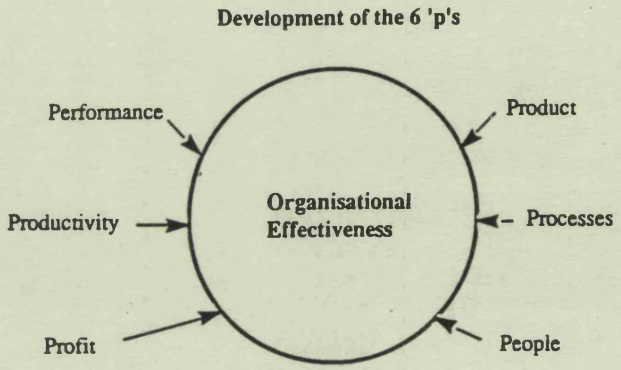
Strengths	Opportunities
e.g. Flexible structure Comitment to quality Customer Service Continuing improvement JIT	e.g. New site Establishing corporate flexibility New product development New products to existing customers
Threats	**Weaknesses**
e.g. Over capacity in industry	e.g. Ageing product Over capacity High costs Inflexibility Leadership Marketing Functional structure Lack of strategic management

Figures 42, 43, 44

- Product Portfolio



- LEADERS ROLE



- Matrix Structure

BUSINESS TEAM

		eg InterConnect	S & A	TAB	EMD
eg	Process Engineering				
CORPORATE SERVICES	Quality				
	Personnel				
	Product Engineering				
	Finance				

Management of change

Apart from its interest in terms of its culture and their approach to management and organization, the significance of Dupont is their approach to the management of change.

Although they are in the high technology business there appears to be a real concern for people and appreciation of the 'socio-technical' nature of the business. Thus, while there is an emphasis on business and technical development, the need for complementary developments in terms of the people and the organization have been recognised. This socio-technical perspective, together with the concept of continuous improvement has helped to ensure a positive approach to technological and organizational change.

Analysis of the company and their approach to developing the 'Bristol Way' showed that change and development may be required in each of the aspects. Thus, change and improvement has been sought and achieved not only in terms of their business strategy and the technology employed, but also in terms of the role and style of management, the structure and organization of work, the people, their knowledge, skills and attitudes and their personal and employment policies.

Their approach to achieving these changes has been through the involvement and participation of those concerned. There appears to be recognition that essentially we are looking at a process of technical change and organizational development.

The company has invested quite heavily in what they describe as 'organizational effectiveness' techniques which influence their approach to tackling problems and managing change. These techniques which are grounded in theory try to ensure that sufficient thought and planning is put into any problem solving activity and process of change. Members of the business and self managing teams are trained in these techniques and all meetings have to be monitored from a process point of view. Thus, all meetings of the business team, for example, an 'organizational effectiveness resource' is made available to monitor the process and give comment and feedback during the meetings. This emphasis on 'the process' aspects of

problem involving is further evidence of a more enlightened approach to managing change.

Thus, while there is still clearly room for further improvement, the culture of the company and their approach to management and organization has helped to ensure the more effective integration of both human and technological needs.

PART V

RESULTS OF RESEARCH AND CONCLUSIONS

CHAPTER 16 - RESULTS OF RESEARCH

The object of the research has been to find out whether it is possible to introduce new technology in a human way. At a time when computers and automation are increasingly dominating people's working lives, the question is whether this has to be at the expense of people and their sense of involvement and satisfaction with their work.

While this question is important in human and sociological terms, I believe it is also relevant to the efficiency and effectiveness of organizations. With increasing emphasis on factors such as quality, flexibility and customer service, the attitudes of staff to the organization of their work and the customer is all important. People will not, however, experience a sense of responsibility and commitment if the results of computerization have effectively taken their job interest and responsibility away. As (Davis, 1979) suggested there is a fundamental contradiction where organizations can spend large amount of money on training programmes to try to make people feel involved and responsible (eg in customer care training and quality circles), but still treat them as automatons on the job with meaningless repetitive tasks with no real responsibility or involvement.

Stage 1

My interest in this field and the impact of technology on people's jobs and sense of involvement stemmed from my own work in the field of job design (Bailey 1983). From my previous research and field work I have been able to demonstrate with practical illustrations the contribution that job design and new approaches to work organization can make to improving both efficiency and job satisfaction. With the ever increasing rate and scope of computerization of manufacture and information systems, the question was *what effect was this having on people, their jobs and their sense of satisfaction and involvement.* Does computerization add or detract from the desirable characteristics of people's jobs such as meaningful goal, responsibility for decisions making, variety, feedback and opportunity for social interaction. Was the popular image of the computer as the enemy of people reducing them to a race of screen watchers and machine minders a realistic picture? What contribution could job design make in this new situation?

These were questions that I needed to know the answers to and which I believed were very important to society in what is an increasingly technological age. My research therefore began very much at the level of the individual and the impact of technology on the nature and content of people's work. I approached this largely through a review of the literature and of published research into different applications of technology. From this initial study I found that while the results varied from one application to another, whether technology had positive or negative effects on people and their jobs was not so much a factor of the technology itself, as the way it was introduced or applied. Thus, while the impact on factors such as task identify, variety, autonomy, social interaction may often be negative, this is more as a result of the assumptions made about the relative roles of people and technology rather than of the technology itself.

This, therefore, led me to the next question, as to *whether or not it had to be this way?* Was it not possible to introduce these systems in a human way? My own hope and belief was that it was possible and that where the right attitudes prevailed and where the knowledge of job design was utilised effectively, it should be possible to design new systems that meet both the needs of the people and the technology.

My faith in this as a possibility has been profoundly influenced by what I saw as the continued and renewed relevance of socio-technical systems theory. This approach and the perspectives involved, while developed in the early 50's, has seemed to me to have a new relevance to the current situation and the application of new technology. The model of the interdependence of social and technical systems does have, for me, an inescapable logic which is also well received and appreciated by people in the field.

Stage II

When I came across an article about what was described as the 'factory of the future' in which a small group of people as a team were running an advanced factory employing computers and a high level of automation, I was most interested and anxious to follow this up. As it proved in practice the flexible manufacturing system at Normalair Garrett not only employed the latest in terms of computerized

manufacturing and management information systems, but also achieved a high level of involvement for the workforce as a result of employing group working and flexibility. While this may have been chosen for largely operational reasons, it illustrated very effectively that alternative forms of work organization could do much to overcome some of the negative consequences of the arbitrary introduction of new technology. It was, in effect, an example of the application of group forms of organization alongside group forms of technology and apart from being 'humane' also proved to be remarkably efficient and effective in terms of costs and effective in terms of delivery and lead times.

However, it was not insignificant that this factory was developed as a new small unit on an industrial estate in a small market town some miles from the main factory. It was for the company in many senses a pilot scheme and feasibility study and despite consultations and the positive attitudes of the unions towards these developments, the experiment was relatively insulated from the company as a whole. The question that therefore arose out of this particular case is whether in 'normal' circumstances it is possible to arrive at a similarly acceptable solution and how to achieve this? While the FMS example was illustrative of what was possible in terms of technical and organizational design, the circumstances of its evolution were, to say the least, very favourable. In a more conventional setting, with the traditions of managerial control, hierarchy, demarcation, restrictive practices and resistance to change, was it possible for such radical and imaginative solutions to be created?

The answer to this question also came about as much by accident as design. Through my involvement with Westlands as a consultant on organization and job design, I became aware of their project on the automation of aircraft loom building. This they had approached initially in what they described as a classical engineering way utilizing job analysis and work study techniques, combined with production engineering and computer systems technology. However, when they came to display a model of the new system, someone suddenly noticed that they hadn't included the people in the model and what was more, they hadn't really decided what the people would be doing in the new system anyway. This was something of a watershed in their own thinking and their approach to the development and

introduction of new technology. Because, from that point on they decided that they needed the involvement of the loom builders themselves, not only to achieve their involvement and acceptance of the new system, but because they needed the experience and expertise in loom building to develop effective alternatives to the traditional manufacturing methods.

The fact that the group described what they were doing as 'job design' was also fortuitous, but they were quick to learn about the value of participative job design to the successful development and introduction of new technology. This case study, while it provided an invaluable illustration of participative job design, also provided some fascinating evidence of the role of technologists in technical and organizational change. The project manager responsible for these developments in the Research and Technology division, experienced something of a transformation in his own ideas and approach to technical change. The experience and success of the loom building project profoundly affected the company's subsequent approach to the development of new technology and its application to the business. Research and Technology Division came to recognise they were initiating both technical and organizational change and development and that as technologists they needed to appreciate the social effects of the changes they were promoting. It was therefore necessary for theResearch and Technology Division to possess or have access to the necessary social skills and resources and to build job design and organisation development concepts into their strategy.

Thus, in relation to the question of if and how it is possible to create acceptable solutions from both a social and technical point of view the loom building case did provide an illustration of what was possible. The fact that it happened as much by accident as design does not detract from the fact that it was possible. Furthermore, there was evidence from the case that it is possible for people and the participants in the change process to learn from the experiment.

In this respect, the role of someone like Barry Mills as a change agent is extremely important. Having a background that was essentially technical, he acquired from his own studies and experience and to some extent from my influence a wider

perspective on these issues. He was in a sufficiently important and pivotal position in the organization to have some influence over events and in particular the way in which the company approached the development and introduction of new technology. Thus, his role and influence in bringing about technological and organizational change was very important and helped to achieve some changes in the strategy employed and in the culture of Westlands. He had both a 'mission' and the power to act.

The other important thing that comes out of both of these two illustrative cases is the potential and opportunity that new technology provides for change. Because of the power and scope of the computer and the far reaching changes implicit to systems of manufacture and information processing, these changes can have important destabilising effects within the organization concerned. This can provide a unique opportunity for unfreezing existing attitudes so that prevailing practices, procedures, relationships and ways of working can be 're-examined' in the light of potential change. Capitalising on these opportunities by effective involvement of the people concerned can make all the difference to a successful process and acceptable outcome in which change has occurred on both social and technical fronts. However, as Barry and his colleagues at Westlands came to realize, these aspects need as much in terms of knowledge, skills and expertise as do the developments of the technical side. The question is why do so few companies seem to realize this?

The Westlands case provides indications of the importance of the prevailing organizational climate in influencing the approach to technological change. Their influence and emphasis on the need to take human and social factors into account probably carried greater weight in a technologically based company because they were technologists. The role played by personnel specialists in this important field often appears to be minimal, if not non-existent, and it seems that it is only when other technologists adopt this position, such as Barry Mills, whose views are respected, that it is possible to influence attitudes on a wider basis.

Stage III

If the first two cases in my investigation illustrated what **was** possible, the second two cases illustrated what is **not.**

When so much is known about job design, why is this knowledge not used? In what is often described as the second industrial revolution, why have we not learned the lessons from the first? When there is evidence that it is possible to match human and technological needs, why does it so rarely occur?

Insights and evidence on these issues arose from the two cases in the third stage of my research. In both cases the approach to the introduction of technology was dominated by technical and economic considerations and, as a result, human and social factors were largely ignored. The results in both cases were, that while savings were achieved, this was at the expense of human involvement and satisfaction and particularly for the longer term interests of the company and their customers.

The first of the two cases, the introduction of an automated paint spraying system employing a robot was, in many senses, the turning point of my investigation. At this point, I felt I had a unique opportunity to be involved and have some influence on the outcome in the introduction of the new system. I had had good relationships with the company for some time and they were partners with me in forming a Teaching Company scheme around the introduction of micro processor systems in several firms. Apart from this, the Managing Director was aware of my knowledge and interest in job design and had even attended one of my residential courses on this subject. As co-ordinator of the Teaching Company scheme, there were no restrictions on my access within the company and I saw this as a very unique opportunity to work with them to try and achieve a 'successful' example of technological change.

However, having expressed my interest at being involved and having been invited to attend the planning meetings, I found that the die was largely cast. The system and its feasibility had already been determined with little or no effective involvement of the people concerned or study of its impact on their jobs or satisfaction. While it was

acknowledged that the resultant jobs could be boring, it was felt that this was an inevitable price to be paid and that the jobs weren't very satisfying anyway. It was felt by management that the staff would be grateful for having cleaner jobs and were not really bothered about being involved.

Despite the fact that I did a study on the paint sprayers and that they derived considerable satisfaction from their work, the threats that the new system posed were largely ignored with the pressures to introduce the new system and get the shop operational again. It was only after the event that these predictions became apparent to all c oncerned when morale and performance in the the paint shop hit an all time low.

As a result of these experiences, some improvements were made in the technical system and in the working conditions. However, although a new supervisor was appointed, who attempted to involve the staff more as a team, these efforts soon floundered in the prevailing technical and production orientated climate. The solution proposed by management rather than any ideas of greater involvement was to downgrade the job on the paint line and to transfer the skilled paint sprayers to other jobs in the factory.

Thus, we come back to the original question of why doesn't it happen? Why, in a situation such as this, where the knowledge of job design existed and where the expertise was readily available, were the human and social factors overlooked?

My analysis and observations on this case suggest that this was due to a number of factors all of which influenced the climate of the organization in which the new system was introduced. These factors which included their strategy for introducing the change, the management structure, the style of management and their assum ptions about people and their motivation, and the industrial relations climate and their approach to systems development all contributed to a culture in which people are seen as subservient to the machine and to management requirements. The culture is one in which 'management still manage' and employees will do as they are told. In these circumstances, technology is seen as a means of minimising human

involvement in the process, thereby reducing costs and increasing management's ability to control.

Job design however is about giving people space and the opportunity to take responsibility and be involved. Such an approach however is quite alien to the environment and culture provided in this and many other industrial companies. People were operating with a quite different model and concept of man, viewing him more as a machine than a person and they were applying their engineering models not only to the technology but also to the form of management and work organization adopted.

My own contention is that new technology requires new forms of management and organization which may require cultural change in order to survive. While, theoretically, a group form of organization in which a team of people without direct supervision could have run the paint shop at Autonomis, the chance of such a solution being accepted or surviving were minimal. It would have taken a major change in attitude and in the culture of the organization for such radical measures to have even been considered. In the absence of any internal 'change agent' with these perspectives and with myself being perceived in all probability as an 'academic idealist' horning in on the act for my own benefit rather than theirs, I was also on a loser in terms of bringing about this type of change. However, for the purposes of my research the case proved to be 'rich' beyond all measure and has provided invaluable case material not only for my thesis but also for teaching purposes.

These findings were very largely reinforced by the second case study of the computerization of an order entry system at Ushers Brewery. While in this case the company was also well known to me and I was well known to them, they had also been operating with small multidisciplinary teams and a high level of employee involvement in their distribution department. Indeed, based on the evaluation that I conducted on their behalf, the company and their Distribution Manager had won the National Distribution Management Award for the innovation which they had achieved. However, despite this experience and the potential learning that this could have afforded, changes in personalities and in the climate, both external and internal, dramatically influenced their approach when it came to introducing tech-

nological change. In the interests of cost reduction, the more effective utilization of resources and of management control, the new computer system was designed and introduced with a minimum level of involvement of the people concerned. The teams were disbanded and the functional divisions re-established. Motivations for staff were based on bonus incentives schemes with the focus on products and sales rather than customers and service. This system, when combined with the changes to the trunking and delivery arrangements, meant that as with Autonumis more of their faith was placed on technology and the people had to fit around these new systems whether they liked it or not. Again, as with Autonumis how far this was in the best long term interest of the company is a somewhat open question. While short term gains in cost reduction, increased sales and greater efficiency may have been achieved, this was at the expense of the involvement and satisfaction of the staff. How far this could also affect people's attitudes to such issues as quality and customer service is also, to some extent, debatable, although in today's environment these aspects are increasingly important. It comes down to how far technology is seen as part of the company's longer term strategic development or as a short cut to cost reduction and greater efficiency.

However, one of the most important conclusions to be drawn from this stage of the investigation is that *even when the knowledge exists, when the opportunities are provided and when the expertise is available, there is still no guarantee that the social factors will be adequately considered.* Whether they are or not is more a function of the attitudes and assumptions of those people involved and of the prevailing climate and culture of the organization concerned.

Thus assumptions and attitudes towards such factors as:

* corporate strategy and technology
* company philosophy and culture
* systems development
* management organization
* job design and work organization
* personnel development strategy
* industrial relations/employment policies

can vitally effect the way the technology is introduced and whether a satisfactory socio-technical result is achieved.

The question that now arises is *if these conditions are important how can they be achieved?* What possibilities exist for influencing the climate and culture of the organization and how can changes in these factors be brought about? It is not without significance that in both the Autonumis and Usher's case there was no internal 'change agent' with a socio-technical perspective. Those involved in designing the new system were either production technologists or systems analysts and did not appear to have any appreciation of the social implications of the changes they were initiating. This lack of awareness, and the fact that the personnel functions were not involved either because they were not invited or failed to take the initiative to be involved, meant that there was nobody acting in the 'guardian angel' of the people and social factors involved. The passive trade union situation in the two cases meant that there was little pressure from that quarter either, which effectively gave management and the technologists their head.

Key individuals with both power and a socio-technical perspective may therefore be an important factor in creating the necessary conditions for socio-technical change.

Stage IV

The issues addressed by the final stage of the research were therefore *how far it is possible to create the necessary conditions for effective socio-technical change.* What are the elements and organizational conditions that are required and how can they be created. Insights and evidence on these issues came from the two complementary case studies in the final stage of my field work. The first case at British Telecom involved the introduction of technological change in a traditional, technically orientated and bureaucratic organization which involved all the problems associated with change in this type of environment.

This contrasted however with the second case at Dupont which was a green field site where by contrast there were virtually no constraints on what was possible in terms of socio-technical design.

The interesting feature of the British Telecom case was the fact that despite it being a very technically orientated company those responsible for processing this change were very sensitive to the social and organizational implications of the new systems.

This case contrasts with the cases in Stage III at Autonumis and Ushers, and corresponds with the situation at Westlands, in that here there were 'guardian angels'. Andrew Shaw and Ron Thomas recognised the technical changes as an organizational development programme and a process of cultural change.

Their perspectives clearly had considerable influence on people within British Telecomm and on the whole approach to change. For example, at the level of job and system design, although the overall concept of the customer service system was developed by the company technologists, staff were involved in the detailed aspects of design, particularly at the level of the machine/human interface. The need for job design expertise was recognised and utilized, but this was not imposed on people but made available as required. As a result, the case illustrates the value of what was a very effective process of participation job design and organizational development. Thus, in socio-technical terms, thought had been put into developing both the socio-technical systems which resulted in a very satisfactory match from both a performance and job satisfaction point of view.

Equally, however, Ron Thomas, the overall project manager, with his OD role and perspective had considerable influence within the organization and with the interested parties concerned. He worked with the Divisional Board of Directors to get their comments on the new system and set up an elaborate committee structure with the Trade Unions and employees. Their use of 'study groups' to involve people at the grass roots level in the implications and particular aspects of the new system seemed to be particularly valuable and these groups fed the more formal evaluation and steering groups.

Despite these efforts problems still existed in the commitment of middle management and the related service function of accounts and maintenance of the new system and the approach required. But the appointment of John Faulkner, previously

Front Office Manager at Newport, as OD Manager for S Wales Division, is evidence of the continuing concern for these issues.

However, more recently changes in personnel at Divisional Manager level and of the Manager responsible for the Front Office operation in South Wales has meant a change in emphasis with greater pressure for performance and output. This, to some extent, is creating a change in the climate and organization and represents something of a setback in achieving the cultural change envisaged.

Thus, in relation to the original question of how far it is possible to create the necessary conditions for change, the British Telecom case is very illuminating. It suggests that if there are people, particularly technologists, with a socio-technical perspective and if people recognise that it is a process of organizational development as well as of technical change, then it is possible to create the conditions for such changes to occur. Whether this can be sustained however is another problem as this case clearly demonstrates as the climate of an organization is very difficult to change.

The final case study of Dupont helps to throw some further light on this particular issue in how to sustain the process of socio-technical change. Interestingly enough, Dupont was brought to my attention by one of my engineering colleagues with whom I had worked on research projects and on the Teaching Company schemes. He was aware of my interests in the social aspects of technological change and indeed as a manufacturing systems engineer was sensitive to these issues himself. He thought that I would be interested in Dupont because as he explained not only were they a high technology company, using new technology and computer based systems of manufacturing and information, but they also had developed a very different and distinctive approach to management and organization. I was therefore very interested to learn more about their approach and to assess how far what appeared to be a socio-technical approach out in practice.

As it happened, my own beliefs appeared to coincide so closely with those involved in the company that I was soon invited to work with them on what they were trying

to achieve. However, this intimate involvement with the firm has given me a unique opportunity to gauge how far their intentions in this direction are genuine and how far they have been successful in achieving them.

The significant thing about Dupont is their fundamental commitment and belief in people as their key resource. This philosophy is based on the tenet that 'if you treat people as if they were what they ought to be, then they will become what they are capable of being'. The phrase, while possibly sounding a bit patronising, nevertheless profoundly influences their whole approach to management, organization, technology and people. The form of organization with its emphasis on self management and teamwork, the style of management with its emphasis on leadership and support, the flat collegiate structure with its lack of emphasis on hierarchy and authority are all designed to give people a real sense of involvement and responsibility. This, coupled with the emphasis on communication, open planning and single status is all designed to help people feel that they all have an equal part to play in running the business and satisfying the needs. While my survey found many areas that need improvement in comparison to the average industrial organization in the approach and the involvement and commitment achieved leaves other companies standing. This is borne out by talking to the technicians themselves, many of whom have come from companies such as Rolls Royce and British Aerospace and none of them would go back to the sort of situation that they experienced there. In fact, only recently I met a Rolls Royce toolmaker socially and in talking about these things I asked him what percentage of his possible contribution to the company did Rolls Royce permit him to give. As I suspected he said that it was no more than 50%, but that was not because of his attitude but because of the system, the approach and attitude of management in the company concerned. Companies like Dupont realise that apart from the waste in human terms they cannot afford this situation in the highly competitive market in which they are operating. They have to be slim, highly flexible and very efficient in order to stay in business and this means achieving the total involvement and commitment of their workforce.

A further significant feature of Dupont, is their openness and their commitment to the concept of continuous improvement. Unlike British Telecom, who were very sensitive to external involvement and influences, Dupont are essentially openly exposing themselves and their way of operating to outsiders and visitors, but also drawing heavily on external sources of advice and support. This, coupled with the commitment to the continuous improvement of all aspects of their business, helps create an orientation to change. Thus, in terms of technology, tasks, processes methods, procedures, staff are expected as part of their with the company to continually be looking for better ways of doing the job. The company do not see the need for quality circles or suggestion schemes which are devices in traditional companies to enable employees to propose changes for management to consider. At Dupont it is part of the employees responsibility to seek better ways and implement them and to inform their leader what they have been able to achieve.

However, this total involvement and commitment to continuous change and improvement can only come if the right supportive climate obtains. As I found in my earlier situation of work restructuring (Bailey 1983) an umbrella and safety valve has to be created which employees can feel secure to participate and initiate change. Nobody is likely to willingly identify, initiate and implement change unless they feel their own interests and security are safeguarded. It is in this respect that the climate and culture that has been developed at Dupont is so important. This culture, with its .commitment to the staff, their involvement and development, to the customer and the quality of product and service given, to the concept of continuous improvement and a management that will not stand over or police people helps to achieve the degree of responsibility and security required. The emphasis on the culture of the organization and the way they want to run their business helps to create a 'stability' within which change and improvement can occur. In these circumstances changes in technology are not seen in any way different to other changes in the organization and the involvement of people in the process is taken for granted. The technicians, apart from their leadership role with the self management teams, are continually looking at ways of improving the processes and are implementing changes within their own operations. Good job design has followed naturally from this stated philosophy and from their belief in people.

Through the self management teams people have been given the space to make decisions, solve problems, work together, learn and develop, innovate and make change. If anything, the problem is not one of involvement and satisfaction, but one of overload. The leaders and technicians in particular complain that they have too few resources to do the job. The other problem is how to maintain personal development and progression in what is essentially a very flat structure and the technicians often complain that there is no future or promotion prospects for them. Part of the problem, as my survey indicated, comes from the use of contractors, where people see the job as a pair of hands and are not prepared to delegate responsibility to them. This means that the contractors themselves are often dissilluisioned and see the jobs purely in instrumental terms.

So while there are problems, and neither I nor the people at Dupont would see what they are doing as perfect, indeed that would be a contradiction in terms, this case study does provide some invaluable clues as to how the process of 'effective socio-technical change' can be sustained. Not only does it mean an awareness of the opportunities for technological innovation or of the needs and opportunities for change in the social structure, it also means a commitment by management to creating the type of climate and culture where people can with confidence participate in improving the effectiveness of the business and take the initiative in doing so. In this context management becomes much more of a 'process' in which everybody can participate than the prerogative of the privileged few.

CHAPTER 17 - CONCLUSIONS

Introduction

Reflecting on my research and what this investigation has been about I have been conscious of the fact that in trying to bring about socio-technical change we are dealing with fundamentally different entities. Technology, by its own nature is 'concrete hard and set' and therefore you need to uproot it sometimes with a pneumatic drill to replace it. People by contrast are living, and are therefore capable of growth, adaption and development. The two sides of the coin are in many senses completely opposed and different.

And yet, in working enterprises, technology and people are completely inter-dependent. A shovel is no good without a person to hold it and people can't dig very far without a shovel. Exactly the same applies to computers. However, when it comes to changing from a shovel to computers this can be done overnight provided the technology is available, indeed it has to be done this way as technology can't be grown. However, people can't be changed overnight, nor with a pneumatic drill. People have to see the need for and be motivated to change and need help and support to develop the new knowledge, skills and attitudes required.

Effects of technology on people

However, technology can constrain man's ability to manage his own work and activities. This was evident from the earlier days of management in F W Taylor's (1947) work in the Bethlehem Steel Company. Here, his study of men shovelling coal caused him to 'define and constrain their approach by determining such factors as the size of shovel, the speed of work and the manner by which the shovel (technology) should be used. These constraints and the institution of functional management with the gang and speed bosses effectively destroyed man's scope of responsibility and motivation which had to be replaced by external financial incentives.

The earlier work on alientation (Blauner 1964) and on peoples' reaction to assembly line work, Walker & Guest (1952), also demonstrates the negative consequence of technology on people and their sense of involvement and responsibility. Similar

results were also obtained when Blauner's ideas on alientation were tested out on banking and insurance workers (Kirsck and Lengermann, 1972). These showed that feelings of meaninglessness and estrangement increased with the degree of automation or mechanisation involved. Their study identified three factors most strongly connected with feelings of estrangement and alientation, namely lack of control over the immediate work process, performance of narrow work roles due to advanced specialization and lack of opportunities for promotion.

Thus, the original question which led me to this research is in what is often described as the second industrial revolution, have we learned the lessons from the past? Does the introduction of 'new technology', ie computer based systems of manufacture and information, also have to be at the expense of people and their sense of involvement and satisfaction? What are the consequences of the introduction of computer based systems on the nature of people's jobs and if it is negative, does it necessarily have to be this way? Also, if not, what is the alternative?

As an individual, with an interest in people and job satisfaction and having developed some knowledge of job design, what contribution can these ideas make in this situation. Can job design contribute to the effective introduction of new technology, and if so, in what circumstances does this apply?

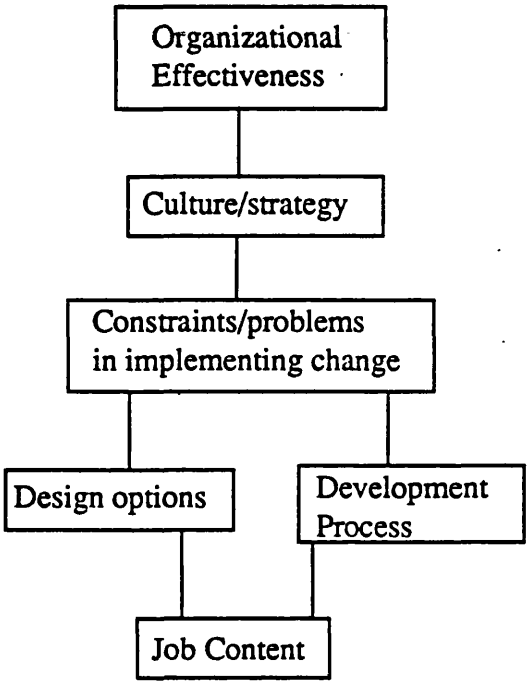
If this was the starting point for my research, what have my investigations shown and where have they finished up?

Progress of the research

While my research started at the level of the individual and their jobs, my investigations and the factors raised have led me to examine wider issues at a higher level with the oenterprises concerned and on the environment in which they operate. Thus, my perspectives, data collection and analysis has progressed from the individual and the nature of their jobs, through the level of work organization to such issues as strategy, structure, communications and interdepartmental relationships. It has, however, also involved issues such as the role and nature of management in enterprises employing advanced technology and the implications that this has for the overall climate and culture of the companies concerned.

In addition to these features which relate largely to the design of jobs, work organisation and corporate structures, the other faeatures of the research have been the increasing emphasis on the change processes and strategies required. Thus, as the research has progressed, I have found the need to concentrate increasingly on the factors that enhance or inhibit the changes required and what this implies in terms of style of management and cultural change. (See Figure 47)

Figure 47 Progress in levels in the research investigation



This has meant that as my research has progressed, the relevance of the thinking and open systems thinking and socio-technical systems theory has become increasingly relevant. My research has also shown the relevance of the literature on strategy and organizational development to the introduction of technological change and its links with corporate culture. I started with a belief in the value of job design to the introduction of new technology. I have ended up with a recognition of corporate strategy and culture to the successful implementation of change. In fact, both notions are important and relevant to the effective introduction of new technology and to the resulting match of human and organizational needs.

FACTORS EFFECTING INTRODUCTION OF NEW TECHNOLOGY

As my research progressed I have been able to identify some of the key factors that effect the introduction of new technology and in particular the achievement of a successful match between organizational, technical and human needs.

These factors, which are summarised below, also form the basis of a model which follows later in the chapter, which highlights the variables concerned, their interdependance and their link with the ultimate effectiveness of the organization.

Impact of technology

One of the first points that emerges from my own research and from the literature is that the impact of new technology and of computer based systems of information and automation is often negative on the people concerned. This however, as the Paint Spraying and Distribution case studies showed, is not so much as a result of the technology itself, but the way that it is introduced and applied. Technology itself appears to be neutral in its impact on people and negative effects where they occur are as a result of the way it is introduced and the assumptions made about the relative roles of technology and people in the enterprise and its operations.

Role of job design

However, my research of both the literature and in the FMS and Loom Building cases demonstrates that while the effects of new technology may often be negative, it does not have to be this way. The knowledge and techniques of job design that are available can, it appears, as the Telecom case demonstrated, play a very valuable role in achieving a more effective match between people's needs and those of the organization and the technology concerned.

The tools and techniques for analysing and predicting the effects of technological change on people's jobs and on such job characteristics as variety, autonomy, feedback and social interaction, are available, eg Hackman and Oldham Survey, and as my own studies in the FMS, Paint Spraying and Districution, and Dupont cases showed, can be applied to good effect in identifying alternatives and options in system and job design.

In this sense, job design as such is not the problem or the issue. It appears that while the knowledge exists it still is very rarely used in the process of introducing technical change. The really crucial question in the research is when so much is known about job design, why is it not used. My research has shown that there are many other factors which bear upon the effective introduction of new technology and the use of job design in the process.

New forms of organization and management

One of the most important factors is that new technology creates the opportunity and need for new forms of organization and management as the FMS cases and Dupont case shows! However as was evident at Autonumis and Ushers, this may not be recognised by those involved, and indeed, if the implications of new technology for changes in these social, as opposed to technical aspects, are recognised, they may well be resisted by those concerned. Thus, for example, where group technology may imply group forms of organization, this can have significant implications for supervisors and for the role of management, which may not either be fully appreciated or welcomed, eg supervision of paint spraying department.

And yet, the very nature of computer based systems of automation and information changes the relationship between technology, and people, and between the information process and control mechanisms involved. In the traditional organization based on specialization and centralization of control, the supervisor and the manager collect information in order to exercise control. In a computerized set up the information is provided by the computer and is readily available to all concerned. This opens up the choice and possibility for the work group to have access to the information and for them to manage and control their own work without the need for direct supervision and with management needing only to provide overall direction and support, eg as was illustrated at Crewekerne and in Dupont.

However, such changes fly in the face of long held assumptions by both management, work people and their representatives, as to their relative roles and about responsibility and decision making in the organization. While it may well be the route to achieving good job design at the level of the individual in a technological

age, it implies big changes in people's attitudes towards their jobs and to the roles they will undertake in these new systems.

The process of participation in analysing, planning, managing and changing can, as Mumford has illustrated and as was shown in both the FMS and Telecom cases, do much to help influence the values andbeliefs held by those engaged in the process. Thus the different values and perspectives and expectations that the managers, technologists, and users start out with are, if the opportunity is taken, also shared through the participative process and a consensus can be reached on what sort of future people are trying to achieve through the change.

Integrating employment conditions

The developments in computer technology can therefore, if allowed, do much to break down the traditional barriers between management and the workforce. The more readily available information and the greater involvement of the workforce in managing their own operations could do much to break these traditional divisions down, especially if accompanied by corresponding changes in working conditions and terms of employment. As was evident in the FMS and Dupont cases, the automated factory, with relatively better standards of cleanliness, even if it is not always quieter than its predecessor, opens up the possibility of office and shop floor people working side by side as part of the same teams, rather than in separate groups with different working conditions.

Functional integration

This introduces a further feature of new technology which my research has highlighted. This relates to the changes that may be implied in terms of the roles and relationships of specialist departments to the line production or service operation. Both in manufacturing and service operations there are indications that changes are required not only in the direct production or service operations themselves, but also in the corresponding and supporting departments. Indeed, the change as nearly all the case studies has shown, raise questions about the relationships between the departments concerned and where the boundaries should be drawn. In Telecom, Dupont, Autonumis and Ushers, the technical change has primarily affected the operating

departments and yet they are dependent for the service they give on the other supporting and service departments concerned. This suggests that in planning these changes, we need to ask who needs to work together to give the customer the product or service they require? The composition of any planning team and the design of the computer systems and corresponding organizational structure should, perhaps, be determined by the answer to this question.

As suggested earlier, my research has shown that not only does new technology have implications for job design and for work organization and for the role of management, it also has implications for organizational structure and interdepartment roles and relationships.

Technologists as change agents

Apart from the concepts of job design and participative strategies for making change, there is clearly a need for an understanding of the process of organizational change and development. Whereas in the 1960's this was seen very much as a behavioural strategy, other commentators and my own research emphasizes the fact that changes can be initiated on several different fronts, not least in terms of technology. Indeed, at the present time, technologists in the form of systems analysts and production engineers, are often the most frequent force for change within organizations and are effectively acting as change agents!

However, as my own and other research has shown, more often than not while their work and the technical systems they introduce create a significant destabilising force within the organization, they do not always have the training or perspectives to integrate and restabilize the changes that they have introduced. This stems from the fact that their own training and the system they develop are based largely on technical and economic factors, with little if any recognition of the human and social implications. The fact that the organization is essentially a socio-technical system, in which change in one system is interdependent on the other, may not be recognised. Indeed, if it is recognised it is more often after the event when the human and other social problems of motivation, communication, organization and management become evident!

departments and yet they are dependent for the service they give on the other supporting and service departments concerned. This suggests that in planning these changes, we need to ask who needs to work together to give the customer the product or service they require? The composition of any planning team and the design of the computer systems and corresponding organizational structure should, perhaps, be determined by the answer to this question.

As suggested earlier, my research has shown that not only does new technology have implications for job design and for work organization and for the role of management, it also has implications for organizational structure and interdepartment roles and relationships.

Technologists as change agents

Apart from the concepts of job design and participative strategies for making change, there is clearly a need for an understanding of the process of organizational change and development. Whereas in the 1960's this was seen very much as a behavioural strategy, other commentators and my own research emphasizes the fact that changes can be initiated on several different fronts, not least in terms of technology. Indeed, at the present time, technologists in the form of systems analysts and production engineers, are often the most frequent force for change within organizations and are effectively acting as change agents!

However, as my own and other research has shown, more often than not while their work and the technical systems they introduce create a significant destabilising force within the organization, they do not always have the training or perspectives to integrate and restabilize the changes that they have introduced. This stems from the fact that their own training and the system they develop are based largely on technical and economic factors, with little if any recognition of the human and social implications. The fact that the organization is essentially a socio-technical system, in which change in one system is interdependent on the other, may not be recognised. Indeed, if it is recognised it is more often after the event when the human and other social problems of motivation, communication, organization and management become evident!

My research has shown that where the change agent, such as Barry Mills at Westlands and Ron Thomas at Telecom, share a socio-technical perspective, especially if they are technologists themselves, this can have a significant influence over the approach adopted to technological change. If however these perspectives are accepted and become part of the culture of the organization such as in Dupont, it is more likely that the human factors associated with the introduction of technical change will be recognised as will the potential contribution of job design to organizational change and development.

Participative job design

For these reasons the use of participative approaches to systems and job design can, as was shown in both the Loom Building and Telecom cases, do much to help people adapt to and accept the new systems and ways of working involved. The scope and scale of the technical changes are often such as to unfreeze existing attitudes of people to their existing jobs and encourage them to willingly participate in developing their new roles. This helps to overcome the inevitable fears and resistance to technological change which have been evident since the Luddites and the first industrial revolution. A participative approach, as the Telecom case illustrated, provides the opportunity for people to learn and develop the new skills required by this type of change, which are often as much social as they are technical in nature. Indeed, if in the new system we are going to require people to work more in teams, to manage themselves and to deal with their customers direct, then as the Dupont case showed they may need the training in terms of communications and interpersonal skills that has long been thought of as the prerogative of management. In fact, the findings from my research particularly at Dupont has reinforced my own contention that in these situations, management should be seen more as a process to which everyone should contribute, rather than the prerogative and function of people who carry the title of management and carry out this exclusive role.

New technology and corporate strategy

From an early stage during my research by the end of the first phase of my field work I had become very aware of the connection between the introduction of new technology and the strategy of the firm. In both the FMS and Loom Building cases my attention had been drawn to the changes that were taking place in the environment of manufacturing industry and in its implications for business and manufacturing strategy. In my analysis of the FMS case I suggested that a company's competitive position depends not only on factors such as prices, but on quality, customer choice, product design and diversity, speed of delivery and back up service. These criteria rather than being based on efficiency alone, put a premium on overall organizational effectiveness and meeting the customers' needs.

This, as I suggested, means that the internal organization and environment of the company needs to mirror the external environment in which it operates and that the design of the organization needs to be seen as a strategic issue central to the effectiveness and survival of the business.

These ideas have been reinforced by recent developments in thinking about strategy which emphasizes the stakeholder model and the changing criteria for business effectiveness. It also emphasizes that strategy is about analysis of both the internal and the external context in which the enterprise operates and is about both content in terms of the decisions made and process as to how the decisions are made. In this sense useful comparisons can be made for example between the strategic decisions made and the process of decision making adopted in the cases of Autonumis and Ushers as opposed to Telecom and Dupont. In the former cases, managements' interpretation of strategy involved an analysis of external context and the need to reduce costs, and decisions about the content of strategy, namely the need for new technology to increase efficiency. They did not however review their inner environment in terms of the structured cultural and political context. Nor for that matter did they include much consideration of the process, ie the actions, reactions and interactions of the interested parties as they moved from this point to their future state. This meant that people and social factors played little part in the process or the eventual solution adopted.

This contrasts with both the Telecom and Dupont case where the approach adopted to strategy incorporated both these concerns particularly in the case of Dupont. Here concern with both the internal and external context and both the process and content of the decisions made, resulted in very different solutions where people and social considerations were seen to be at least as important, if not more important, than technical considerations in fulfilling the company's strategic goals.

This endorses the suggestion that strategic management is about sensing, articulating and implementing major changes in business strategy, structure, culture, technology and people in order to ensure business success.

Thus, strategy and the approach adopted to it can be seen as a major factor influencing the way in which new technology is introduced and these ideas and the inter-relationships between the variables concerned are reflected in the model I have developed.

Organizational culture

While my research has emphasised the importance of relating the introduction of new technology to the strategy and objectives of the organization, it has also highlighted the relationship to its culture. Whereas strategy may refer to the more specific goals and objectives of the organization in terms of its development, culture is more a reflection of the beliefs, values, attitudes and norms that prevail in the organization and influence peoples' behaviour and attitudes towards change.

The notion of culture, as others have found, has proved to be particularly significant in influencing the approach adopted to the introduction of new technology. To a large extent the culture and the degree to which there are common values that are shared about such things as the importance of people, to satisfaction and participation, help to determine the approach that is adopted to technological change. Where people share in the belief that these things are important not only from a human point of view, but also in terms of organization effectiveness and providing customer satisfaction, these values will tend to condition their approach to the role of technology and the introduction of change, eg Dupont.

While my research has also examined the role of the change agent and the importance of adopting a socio-technical perspecti ve, is this insufficient to ensure continuing technical change and organizational development? eg Loom Building and Telecom case. While a particular project may be successful, the question is whether they will continue once the change agent has gone. As earlier discussion has shown the implications for change in attitudes, roles, relationships and structure and style are far reaching and amount to a new paradigm of organization. This, like any flower, can perish in a hostile environment.

It is at this point that my research connects with the current interest and awareness of the importance of the climate and culture of the organization in facilitating and sustaining change. Evidence from the case studies demonstrate that the nature of the culture of the organization has a profound effect on the approach adopted to the introduction of new technology.

Such issues as attitudes within the organization to innovation, belief in people, quality and service to the customer, have a strong bearing on the approach to technological change and to the role of people within the process. Indeed, whether management see it as their task to direct and control, or to manage and facilitate, profoundly influences their approach to change and organizational development (Stout 1980).

The existence of a supportive culture which is clearly articulated can do much to create the stability in which people can participate in organizational change. This and an openness to external pressures for change, can help to maintain organizational effectiveness in increasing complex and changing environments.

It is here that the work of people like Mumford, drawing attention to the effects of political aspects and differences in values of participants on the introduction of new technology. Her work and those of other people who are interested in the problems of achieving cultural change, eg Marshall and Mclean, Bate and Potter, draw attention to the importance of recognising these differences and approaching these questions from a number of different perspectives.

One cannot explain the differences in peoples values and expectations as regards these changes from an economic standpoint alone. The cultural perspective, with its recognition of economic, social, political and ethical considerations, means that we should look at the issues from a number of points of view. Thus management's concern with power and control, the shop floor concern for kinship and social support, and the technologists faith in technology can be more readily predicted and appreciated from a cultural perspective.

In planning change we have to accept that different groups in the organization such as managers, systems analysts and users may have different values and beliefs that effect their approach to the problem and their expectations.

Thus, in planning change simply expecting people to be more customer oriented may not have the desired effect and the perceived behaviour of people in the organization may not reinforce this message. In planning change we have to 'start with people where they are at' and this means finding out both what people believe in and what they see as a desirable future and what they perceive the current situation to be. It is only then, through a process of sharing, exchange and participation such as described by Mumford and evidenced in such examples as Telecom and Dupont, that common values and goals can be identified.

This means that the change agents and those involved in planning the change process need not only a socio-technical perspective, but an ability to understand and identify with the values of the different parties involved, ie they need to adopt an 'emic' approach.

For such change to be truly successful in the long term, there needs to be someone in the organization, ideally in the role of senior management, who can act as a 'Guardian Angel' over the change process, who appreciates the need for a socio-technical perspective and space in which the differences and values and expectations can be expressed and encouraged in order for some concensus to be achieved.

In this sense the role of senior management could perhaps be likened to that of the conductor of an orchestra who, with an eye to the needs and expectations of his audience, orchestrates the contribution of his musicians to achieve a successful performance.

At this point the ideas of strategic and cultural change begin to merge in the role of top management in facilitating change and development and the maintainance of organizational effectiveness in today's complex and changing environment.

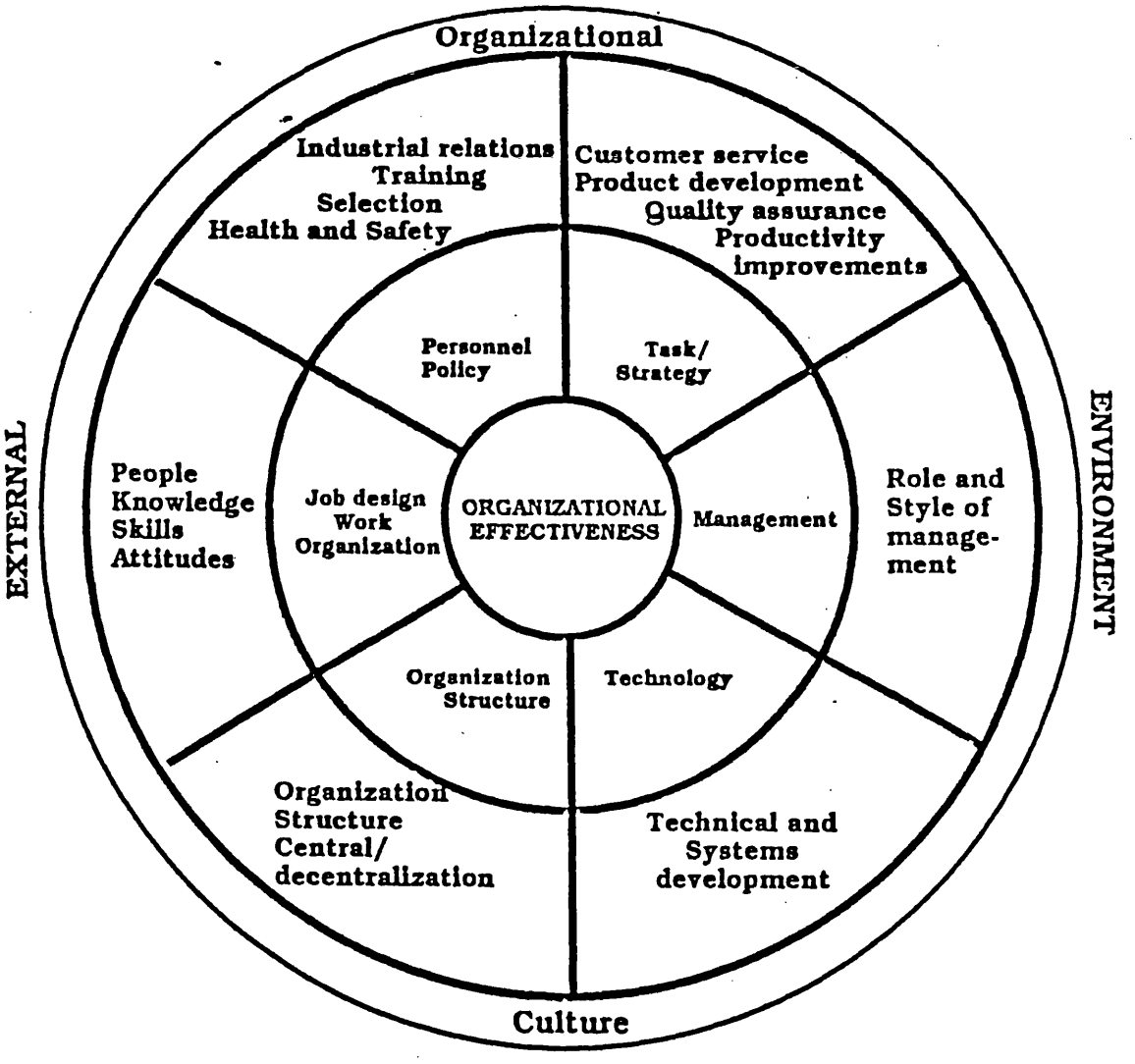
A model for the effective introduction of new technology

As my research has developed I have been able to demonstrate progressively some of the key factors relating to the effective introduction of new technology. These issues, many of which I was able to identify towards the end of Phase III of the research, provided a basis for my research in the final stage and provided a framework for my analysis of the Dupont case.

They also formed the basis of a model in which I depict some of the key variables concerned and their inter-relationships both with one another and to the ultimate effectiveness of the organization. Thus, for example, we know that changes in technology need to be related to the strategy of the organization and that, in turn, these are related to the role of management and the organization structure. Changes in technology may also require changes in work organization to achieve good design and this, in turn, can have implications for personnel policy .

However, the model also illustrates that an organization has choices in each of these areas and that these in effect form interdependent variables on which the successful introduction of technological change depends. Thus, for example, if an organization sees its objective for introducing new tehcnology largely in terms of reducing costs through reductions in manpower, this is likely to influence their attitudes and decisions on the other variables concerned. The technology will tend to be dominant with the system analysis of production engineers making their decision independently of the user and the work force. This will also have implications relating to the form of management and organization adopted and to job design and personnel policies.

Figure 33 **Key Organizational Variables for Introduction of New Technology**



Alternatively if an organization sees its strategy in terms of improving quality and service to the customer, while offering value for money this is likely to effect their approach not only to the introduction of the technology and the design of the system, but also to the other variables concerned. Thus, apart form adopting a participative approach to systems design the organization may recognise the need to involve people more effectively, eg through the development of a more decentralised and federal type structure, employing self managing teams and forward looking personnel policy.

Whether an organization adopts these attitudes however does appear to be dependent on the prevailing culture of the organization. Culture which can be summarised as the values, beliefs, attitudes and norms which are prevalent in an organization and particularly amongst management and the decision makers tends to precondition peoples' approach to the issues and options concerned. Thus, whether management believe in the importance of people and their job satisfaction and involvement and whether they value such concepts as participation, innovation, quality and customer service will tend to precondition their approach to strategy, planning and technological change. Culture as my model suggests forms some sort of umbrella under which these decisions and changes are made.

However, it also effects the extent to which the organization is open to the external influences of the environment and its consequent ability to adapt to change. A management who feel that they know it all will neither be open or adaptive and these attitudes will be reflected internally. By contrast a management who believe that they can learn from observation and information from other people, both externally and internally are likely to be more open and receptive to change. In these circumstances management as the sponsors of change are more likely to give the change agents their head. The change agents, who are not only the systems analysts and production engineers, but also accounts, personnel specialists and management consultants can help to alert the organization to the opportunities and needs for change provided the climate of the organization permits it and act as facilitators to bringing the change about.

Thus, the model attempts to show not only the varibales and their relationships, but also the processes by which successful change can be accomplished.

Links with literature and its development

My research has, if anything, reinforced existing literature rather than refuting it. It has demonstrated and endorsed the relevance of the concepts of job satisfaction and job design to the introduction of new technology. The techniques and methodologies that have been developed for measuring and predicting change in job content and satisfaction have been shown to be effective and can be used successfully in these circumstances. Similarly, my research has re-endorsed the relevance of socio-technical systems thinking to this type of change and has brought these concepts to the forefront of current developments (Beinum 88).

In this respect my research has added to and emphasised the relevance of the literature on new forms of management and organization, for example, on group forms of organization, self management and high performance work systems (Buchanan and Boddy 87).

In addition my work has reinforced the relevance of current literature and thinking on strategy and strategic change to the introduction of new technology. The work of people like Johnson and Scholes and of Pettigrew et al emphasizes the links between the strategic decisions and the way they are made with the relative roles of people and technology. Indeed if strategy is about both where the organization is going and about how it is going to get there, then it is about both the planning process and the type of organizational response required. In this sense strategy, structure, technology and people are inevitably linked to ensure success in today's business enviornment.

It also demonstrated the importance of work of people like Mumford who have drawn attention to the significance of values in influencing the effectiveness of the fit between technical and human needs.

It is in this areas that my own work links with the current interest in the culture of the organiztion and the extent to which this influences and enables the effective

introducion of technological change. While my own analysis of Dupont formed a keynote paper for the conference on 'New Technology and Management Culture in the 1990's' there is clearly scope for more research in this area.

The questions now are not so much about the relevance of job design to the introduction of new technology, nor to the need for new forms of management and organization. Nor are the questions so much about the importance of culture to the effective technological change. The questions that now need to be addressed are if the culture and a consensus on human values are a precondition to effective introduction of new technology, how can we change the values and create such a culture for these changes to take place. The work of people like Marshall and McLean, Bate and Potter are helping us to understand these issues. However, the study of organizational culture and how to bring about its change is still very young and it would need another thesis to do this subject justice.

REFERENCES

ANSOFFH I (1968) *Corporate Strategy* Harmondsworth, Middlesex, Penguin Books

APEX (1985) *Job design and new technology*. Association of Professional, Executive and Computer Staff

BAILEY J R S (1976) Organization Design. Unpublished MBA paper for project at Henley Admin Staff College

BAILEY J R S (1980) People and the impact of new technology, *Educational and Commercial Training* Vol 12, No. 9.

BAILEY, J R S (1983) *Job design and work organization*. London Prentice Hall International

BAILEY, J R S (August 1984) Winning customers through employee involvement, *Long Range Planning* Vol. 17, No. 4

BAILEY J R S (1988) Organizational conditions for introduction of new technology. Paper presented at fifth workshop on capitalist and socialist organizations, Yugoslavia.

BATE P (1988) The cultural paralysis of innovation within largescale bureaucracies. Paper for fifth workshop on capitalist and socialist organizations, Yugoslavia.

BEINUM H VAN (1988) New Technology and Organizational Choice *Journal of Ontario Quality of Working Life Centre*, Vol. 6, Issue 1

BIRCHALL D & CARNELL C (1974) The design of jobs and an outline strategy for diagnosis and change, *Management Services*

BLAUNER R (1964) *Alienation and freedom*. Chicago, Chicago University Press

BUCHANAN D & BODDY D (1983) *A case study of biscuit manufacturers in organization in the computer age.* Farnborough, Gower

BUCHANAN D & BODDY D (April 1985) New technology with a human face, *Personnel Management*

BUCHANAN D & BODDY D (May 1988) Job Enrichment in Death. Long live high performance work design. *Personnel Management*

BURBRIDGE J L (1976) Group product methods and humanization of work, *International Labour Office*

CHANDLER A D (1962) *Strategy and Structure* Cambridge Mass. MIT Press

CHERNS A B (Winter 1973) Can behavioural scientists help managers improve their organizations, *Organizational Dynamics*

CHILD J (1972) Organization structure, environment and performance, Role of Strategic Choice Sociology, Vol. 6

CHILD J New technology and development in management organizations, *OMEGA International Journal of Management Science*, Vol 12, No. 3

CLARK P A (1972) *Action, research and organizational change*, New York, Hooper & Row

CLUTTERBUCK D & GOLDSMITH W (1984) *The winning streak*, Penguin

DAVIS L E & TAYLOR J R (1979) *Design of jobs*, Santa Monica, California Goodyear

EMERY F E & TRIST E L (1965) Casual Venture of Organizational Environments. *Human Relations* Vol 18. pp 21-32

EMERY F E (1969) *Form and content in industrial democracy*, London Tavistock Publication

GALBRAITH J R (1971) Matrix organization design, *Business Horizons*

GLASER B E & STRAUSS A L (1967) *Discovery of grounded theory.* Strategies for Qualitative Research, Aldine

HACKMAN J R & OLDHAM E (1975) A new strategy for job enrichment, *California Management Review*. XVIII (4)

HACKMAN J R & OLDHAM E R (1980) *Work re-design*. Addison-Wesley

HAZELHURST J et al (1979) Numerically controlled machines and machinist skills in *design of jobs*. Eds Davis L E & Taylor J C, Santa Monica, California, Goodyear

HENNESTAD B W (1988) Double bind and the dynamics of organizational culture. Paper prepared for fifth workshop on capitalist and socialist organizations. Istambul

HILL C P (1971) *Towards a new philosophy of management*. London, Gower Press

JOHNSON F & SCHOLES K (1984) *Exploring Corporate Strategy* Prentice Hall International, London.

KIRSCH B A & LENGERDANN J J 'An empirical text of Robert Blaunis ideas on alienation in work as applied to different types of jobs in white collar settings" *Sociology and Sociaological Research* Vol. 5 pp 485-500

MARK P (1981) Britain advances in computerized factors, *New Scientist*

MARSHALL & McLEAN (April 1985) Employing organizational culture as a route to organizational change in Hammond V. (Ed). Current Research in Management, London, Francis Pinter.

MILLS B (1984) A phased approach to alternative loom technology - A Case Study. In Proceedings of 1st International Conference on Human Factors in Manufacturing, Ed T Lupton, I F S

MUMFORD E (1981) *Values, Technology and Work.* Martenus Richoff

MUMFORD E (Spring 1976) Strategy for re-design of work. *Personnel Review, 5 (2)*

MUMFORD E (1983) *Designing Human Systems* Manchester Business School

NEW C (1978) What we need is a marketing and manufacturing strategy. *Sunday Times*

PETTIGREW A ED. (1987) *The Management of Strategic Change* Blackwell Oxford.

PETERS T J (1982) *In search of excellence*. Harper & Row

POTTER C (1989) What is Culture. *Leadership and Organizational Development.* Vol. 10 No. 3

ROSENBROCK H (1981) Engineers and the work people do *IEE Control Systems magazine*. Vol 1, No. 3

SCHEIN E (1965) *Organizational psychology*. Inglewood Cliffs, NY, Prentice Hall

SCHUMAKER E F (1973) *Small is beautiful*. Blond and Briggs

STOUT, R J R (1980) *Management on control*. The organizational challenge, Indiana University Press, Bloomington, London

TAYLOR F W (1947) *Scientific Management*. New York, Harper & Row

TRIST G (1981) *Evolution of socio-technical systems*. Occasional Paper No. 2. Ontario Quality of Working Life Centre

TRIST E L & BAMFORTH R W (1981) Some social & psychological consequences of the long-wall method of coal getting. *Human Relations 4, 3-38*

TURNER A N & LAWRENCE P (1965) *Industrial jobs and the worker* - An investigation into the response to task attributes. Cambridge, Mass. Harvard University Graduate School of Administration

WALKER C R & EVEST R H *The Man on the Assembly Line* Cambridge, Mass. Harvard University Press 1952

WALL T (1984) What's new in job design. *Personnel Management*

WILD N (1985) *Work organization*. New York, John Wiley

WILKINSON B (1983) *The shop floor politics of new technology* London, Hienmann

WOODWARD J (1965) *Industrial organization theory and practice*. Oxford University Press

APPENDIX 1 - NEW TECHNOLOGY QUESTIONNAIRE

TECHNOLOGY

1. Why did the Company change or introduce the new system?
   What were they trying to achieve?

2. From where did the pressures come for change? **internal**
   external

3. What were the driving forces? **costs**
   competition
   flexibility
   quality
   speed of delivery

4. What has been the nature of the change in terms of technology?
   What new equipment has been introduced and what did this replace?
   What change does this represent in terms of investment per employee?

5. How was the new system designed/developed **package**
   purpose-built
   in house/external
   expertise

6. What are the advantages of new system from the Company's point of view?

7. Benefits/results.

   a) Company?
   - **O/P**
   - **Productivity**
   - **Cost reduction**
   - **Speed of delivery**
   - **Quality**
   - **Industrial relations**

   b) For Employees?
   - **Job security**
   - **Job interest**
   - **Involvement**
   - **New opportunities**

TASKS/JOBS

1. In what ways have there been changes in the number and nature of job involvement?

   a) Changes in type and number, eg increased programmes etc,
   - programmes always there.

   b) Changes in Tasks/Job Content
   - Assembly
   - Testing
   - Measuring/Inspection
   - Monitoring
   - Planning

2. How far has it affected the characteristics of the jobs eg
   - Variety
   - Autonomy
   - Task Identity & Significance
   - Feedback

* ***Use Job Diagnostic Survey to validate opinions expressed***

PEOPLE

1. How has the new system affected the type of staff you are looking for/need?
   - Age
   - Training/Qualifications

2. What changes are required in terms of -

   a) Knowledge - eg computing, machines

   b) Skills - decision making
      - programming
      - perception

   c) Attitudes
      - towards learning new skills
      - flexibility
      - involvement in decision making

   ie What sort of person is needed if system is going to work successfully?

3. What special education/training was given or is needed?

4. Where have you recruited people for new system from and what problems have been experienced in getting the right staff?

STRUCTURE

1. What ways have new systems required changes in organisation structure?

   What changes have been made in the type of structure employed?

   Has that following increased or decreased?

   i. levels - number of levels in hierarchy

   ii. degree of supervision involved/span of control

   iii. specialisation - eg programmers/operators

   iv. flexibility between tasks and jobs

   v. degree of involvement in decision making increased or decreased (use check list)

   vi. centralisation/decentralisation has it increased or decreased?

   vii. individual/group/team approach

   viii. independence/interdependence

   ix. formality/informality

   x. have these changes led to increase or decrease in the size of operational units?

   xi. what changes have been necessary in the wage or salary structure in thenew system?

INTRODUCTION OF CHANGE

1. How was the introduction of new system handled?

2. Which departments were involved in planning the new system -

   - production engineering
   - systems analysts
   - personnel/training
   - design
   - Trade Unions
   - employers/operatives

3. How long did it take to develop and implement the change?

4. How has the exercise been co-ordinated?

5. What have been the main constraints and problems associated with its introduction -

   - resistance from TUs/unemployment issue
   - resistance from employees
   - technical problems eg programming
   - departmental resistance or conflict
   - cost implications
   - resistance from managers/supervisors

6. Did you have/do you have a New Technology Agreement - if so

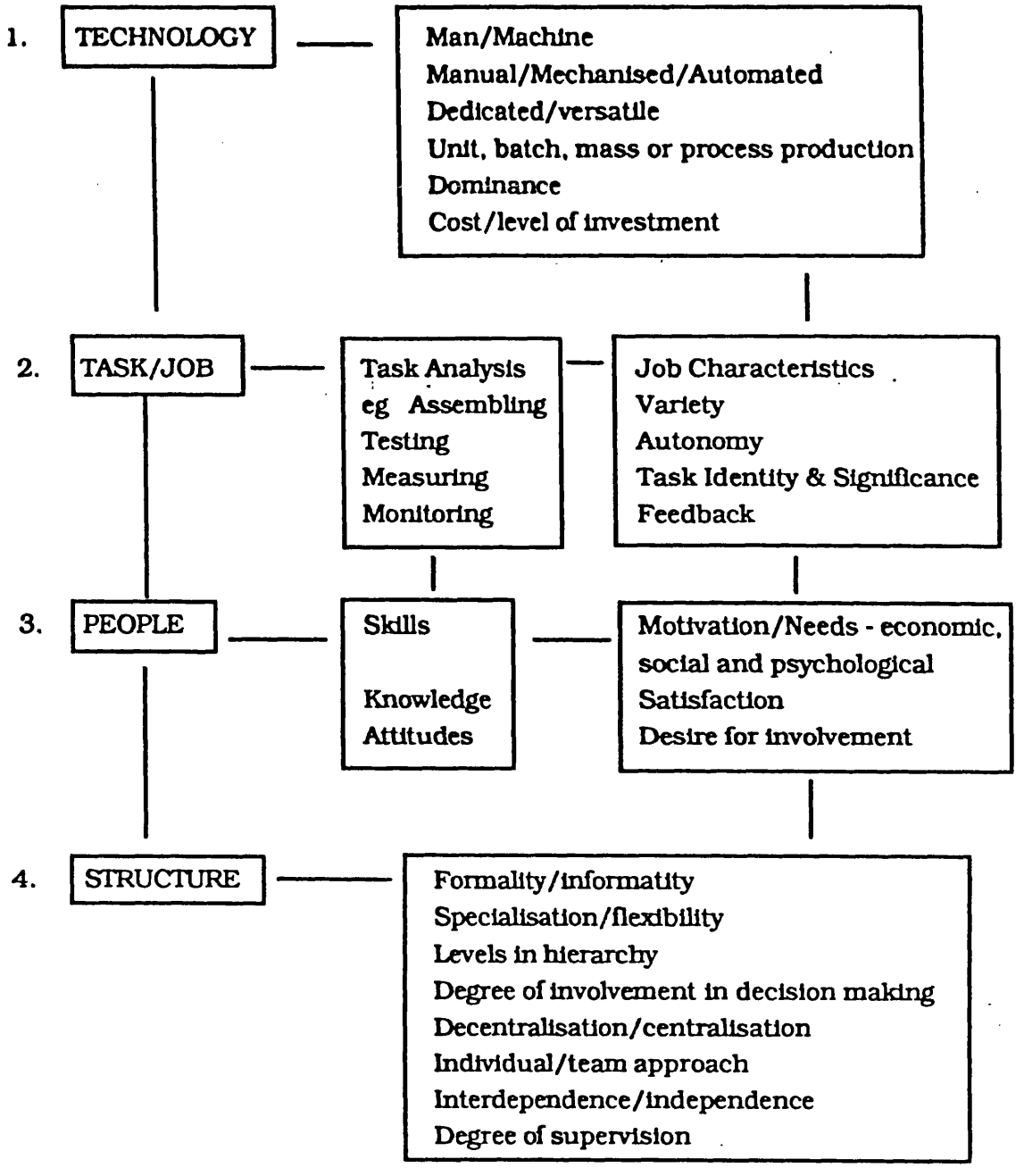
   - with which Union?
   - what aspects does it cover?
   - how helpful do you believe it is to have a New Technology Agreement?

7. How have you handled the redundancy/unemployment issue?

8. What do you feel has been learnt from the experience?

   What recommendation would you give the other organisations contemplating this type of change?

APPENDIX 2



Key Variables in Socio-Technical Systems

JOB DIAGNOSTIC SURVEY

This questionnaire was developed as part of a Yale University study of jobs and how people react to them. The questionnaire helps to determine how jobs can be better designed, by obtaining information about how people react to different kinds of jobs.

On the following pages you will find several different kinds of questions about your jobs. Specific instructions are given at the start of each section. Please read them carefully. It should take no more than 10 minutes to complete the entire questionnaire. Please move through it quickly.

The questions are designed to obtain <u>your</u> perceptions of your job and <u>your</u> reactions to it.

There are no "trick" questions. Your individual answers will be kept completely confidential. Please answer each item as honestly and frankly as possible.

Thank you for your cooperation.

For more information about this questionnaire and its use, please contact:

Prof. J. Richard Hackman
Department of Administrative Sciences
Yale University
New Haven, Connecticut 06520

OR

Prof. Greg R. Oldham
Department of Business Administration
University of Illinois
Urbana, Illinois 61801

SECTION ONE

This part of the questionnaire asks you to describe your job, as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and as objective as you possibly can.

A sample question is given below.

A. To what extent does your job require you to work with mechanical equipment?

1----------2----------3----------4----------5---------(6)---------7

Very little; the job requires almost no contact with mechanical equipment of any kind.

Moderately

Very much; the requires almost constant work w mechanical equi

You are to circle the number which is the most accurate description of your job.

If, for example, your job requires you to work with mechanical equipment a good deal of the time--but also requires some paperwork--you might circle the number six, as was done in the example above.

If you do not understand these instructions, please ask for assistance. If you do understand them, turn the page and begin.

1. To what extent does your job require you to work closely with other people (either leaders or people in related jobs in your own organisation)?

1----------2----------3----------4----------5----------6----------7

Very little; dealing with other people is not at all necessary in doing the job.	Moderately; some dealing with others is necessary.	Very much; dealing with other people is an absolutely essential and crucial part of doing the job.

2. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1----------2----------3----------4----------5----------6----------7

Very little; the job gives me almost no personal "say" about how and when the work is done.	Moderate autonomy; many things are standardized and not under my control, but I can make some decisions about the work.	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.

3. To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1----------2----------3----------4----------5----------6----------7

My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service.	My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome.	My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service.

4. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1----------2----------3----------4----------5----------6----------7

Very little; the job requires me to do the same routine things over and over again.	Moderate variety	Very much; the job requires me to do many different things, using a number of different skills and talents.

5. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1----------2----------3----------4----------5----------6----------7

Not very significant; the outcomes of my work are not likely to have important effects on other people.	Moderately significant	Highly significant; the outcomes of my work can affect other people in very important ways.

6. To what extent do leaders or co-workers let you know how well you are doing on your job?

1----------2----------3----------4----------5----------6----------7

Very little; people almost never let me know how well I am doing.	Moderately; sometimes people may give me "feedback"; other times they may not.	Very much; leaders or co-workers provide me with almost constant "feedback" about how well I am doing.

7. To what extent does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing--aside from any "feedback" co-workers or leaders may provide?

1----------2----------3----------4----------5----------6----------7

Very little; the job itself is set up so I could work forever without finding out how well I am doing.	Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not.	Very much; the job is set up so that I get almost constant "feedback" as I work about how well I am doing.

SECTION TWO

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or an inaccurate description of your job.

Once again, please try to be as objective as you can in deciding how accurately each statement describes your job--regardless of whether you like or dislike your job.

Write a number in the blank beside each statement, based on the following scale:

How accurate is the statement in describing your job?

1	2	3	4	5	6	7
Very Inaccurate	Mostly Inaccurate	Slightly Inaccurate	Uncertain	Slightly Accurate	Mostly Accurate	Very Accurate

____ 1. The job requires me to use a number of complex or high-level skills.

____ 2. The job requires a lot of cooperative work with other people.

____ 3. The job is arranged so that I do not have the chance to do an entire piece of work from beginning to end.

____ 4. Just doing the work required by the job provides many chances for me to figure out how well I am doing.

____ 5. The job is quite simple and repetitive.

____ 6. The job can be done adequately by a person working alone--without talking or checking with other people.

____ 7. The Leaders and co-workers on this job almost never give me any "feedback" about how well I am doing in my work.

____ 8. This job is one where a lot of other people can be affected by how well the work gets done.

____ 9. The job denies me any chance to use my personal initiative or judgment in carrying out the work.

____ 10. Leaders often let me know how well they think I am performing the job.

____ 11. The job provides me the chance to completely finish the pieces of work I begin.

____ 12. The job itself provides very few clues about whether or not I am performing well.

____ 13. The job gives me considerable opportunity for independence and freedom in how I do the work.

____ 14. The job itself is not very significant or important in the broader

SECTION THREE

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own, personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

_ _ 1. My opinion of myself goes up when I do this job well.

____ 2. Generally speaking, I am very satisfied with this job.

____ 3. I feel a great sense of personal satisfaction when I do this job well.

____ 4. I frequently think of quitting this job.

____ 5. I feel bad and unhappy when I discover that I have performed poorly on this job.

____ 6. I am generally satisfied with the kind of work I do in this job.

____ 7. My own feelings generally are not affected much one way or the other by how well I do on this job.

SECTION FOUR

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

How satisfied are you with this aspect of your job?

1	2	3	4	5	6	
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Satisfied	Extrem Satisf

____ 1. The amount of job security I have.

____ 2. The amount of pay and fringe benefits I receive.

____ 3. The amount of personal growth and development I get in doing my job.

____ 4. The people I talk to and work with on my job.

____ 5. The degree of respect and fair treatment I receive

____ 6. The feeling of worthwhile accomplishment I get from doing my job.

____ 7. The chance to get to know other people while on the job.

____ 8. The amount of support and guidance I receive from leaders.

____ 9. The degree to which I am fairly paid for what I contribute to this organization.

____ 10. The amount of independent thought and action I can exercise in my job.

____ 11. How secure things look for me in the future in this organization.

____ 12. The chance to help other people while at work.

____ 13. The amount of challenge in my job.

____ 14. The overall quality of the leadership I receive in my work.

SECTION FIVE

Listed below are a number of characteristics which could be present on any job. People differ about how much they would like to have each one present in their own jobs. We are interested in learning how much you personally would like to have each one present in your job.

Using the scale below, please indicate the degree to which you would like to have each characteristic present in your job.

NOTE: The numbers on this scale are different from those used in previous scales.

4	5	6	7	8	9	10
Would like having this only a moderate amount (or less)			Would like having this very much			Would like having this extremely much

____ 1. High respect and fair treatment from my leader.

____ 2. Stimulating and challenging work.

____ 3. Chances to exercise independent thought and action in my job.

____ 4. Great job security.

____ 5. Very friendly co-workers.

____ 6. Opportunities to learn new things from my work.

____ 7. High salary and good fringe benefits.

____ 8. Opportunities to be creative and imaginative in my work.

____ 9. Opportunity for promotion.

____ 10. Opportunities for personal growth and development in my job.

____ 11. A sense of worthwhile accomplishment in my work.

APPENDIX 4 - Proposed further study

If the fundamental restructuring of Westland Helicopters is agreed to be worthy of detailed investigation in the context of securing the company's future, consideration of how to proceed is required. The following course is proposed:

1. Identify who - in management and worker representative groups - is thinking in chorus with the general ideas expressed above.

2. Form a five person (three management and two union?) steering group to pursue enquiries.

3. Educate the group in current work organisation practice, job design theory and practice, current socio-technical projects etc (consultant required).

4. Organise general discussion in group.

5. Identify a key area for study (eg a candidate ilôt).

6. Recruit to the steering group a worker and management representative of that area.

7. Group present activity to date to two new members. Discuss scope.

8. Group draw up a hypothesis and a plan for studying same for subject area.

9. Group study general practicalities.

10. Group design structure in detail - in terms of physical layout, management structure, supervisory structure, communications (both within and outside of area) accountability procedures (target and achievement information/ publication).

11. Group estimate effectiveness of proposals.

12. Group consider alternatives.

13. Group draft and publish report and follow up with presentations to mixed management and worker groups.

Throughout the group's activities it is proposed that they should regularly meet and discuss progress with monitors comprising the co-ordinator of these studies, the senior manager or director of the subject area, a senior union representative.

The dissolution of the group will be decided dependent on the outcome of their recommendations and the possibility of their roles in implementation.

TEACHING COMPANY SCHEME.

REPORT OF SURVEY AND DISCUSSIONS WITH PAINT SPRAYERS.

AT AUTONUMIS

Objective

The aim of this survey is to establish how the paint sprayers job will be effected by the introduction of the new automated system.. It is hoped that this information can be used in planning the organisation of work in the new system in such a way that it will be both efficient and satisfying to the people concerned.

Method

The survey was carried out with the aid of a questionnaire which has been developed and validated by extensive research (Ref.1). Interviews were held with supervisors and the permanent staff to assess their attitudes to their current jobs and their perceptions of how their job will be effected by the change to the new automated system. A verbal feedback has been given to the participants and a written summary prepared for the benefit of management.

Current situation

Contrary to what might be supposed, the paint sprayers have quite a high regard for the essential nature of their job. They see it as an inherently skillfull task from which it is possible to derive a good deal of satisfaction.

In particular they feel that the job is important because the quality of the finished paint work is one of the first things people see. They can exercise a relatively high degree of discretion in deciding how to do the job and also obtain direct feed back on the quality of their own work.

Regarding other factors surrounding the job there is rather less satisfaction. They do not appear to be very satisfied with factors such as pay, security and supervison where they feel that there is insufficient feedback on their performance and recognition of their work. They are also slightly dissatisfied with the degree of social contact in the job and the opportunities that it provides to learn new skills and for personal development.

Overall, however, there is relatively high degree of general satisfaction and people are motivated to do a good job. A summary of the scores on these various factors is shown at Appendix A.

Change to automated system.

While most people welcome the improvement that the new system will give from a health point of view and in terms of working conditions, there is concern that the jobs in the new system will be boring and monotonous.

In particular they feel that there will be less demand for their skills and that there will be less variety in the new situation. Whereas at the moment everybody can approach the job in their own way with the new system this will all be pre-determined. There will not be the same direct feedback to the operator on his performance nor the feeling of being involved in the whole task.

Operators Preferences.

However the extent to which these problems will arise is in their view very much dependent on the way the work is organised. From their point of view they would prefer a degree of rotation within the new system so that everyone is involved in the total task. Thus each operator would, over a period, be involved in 'tacking' and degreasing, loading, unloading and inspection together with some hand spraying. This they suggest would restore some of the variety they currently experience, could give them some degree of discretion in organising their own work and provide feedback on performance and quantity of work produced by the system.

Some concern was expressed that communications regarding the new systems would be improved and that some factors that are important to the people concerned such as pay had been left until a very late stage.

However generally there appeared to be a willingness to try the new system out and to approach it with an open mind.

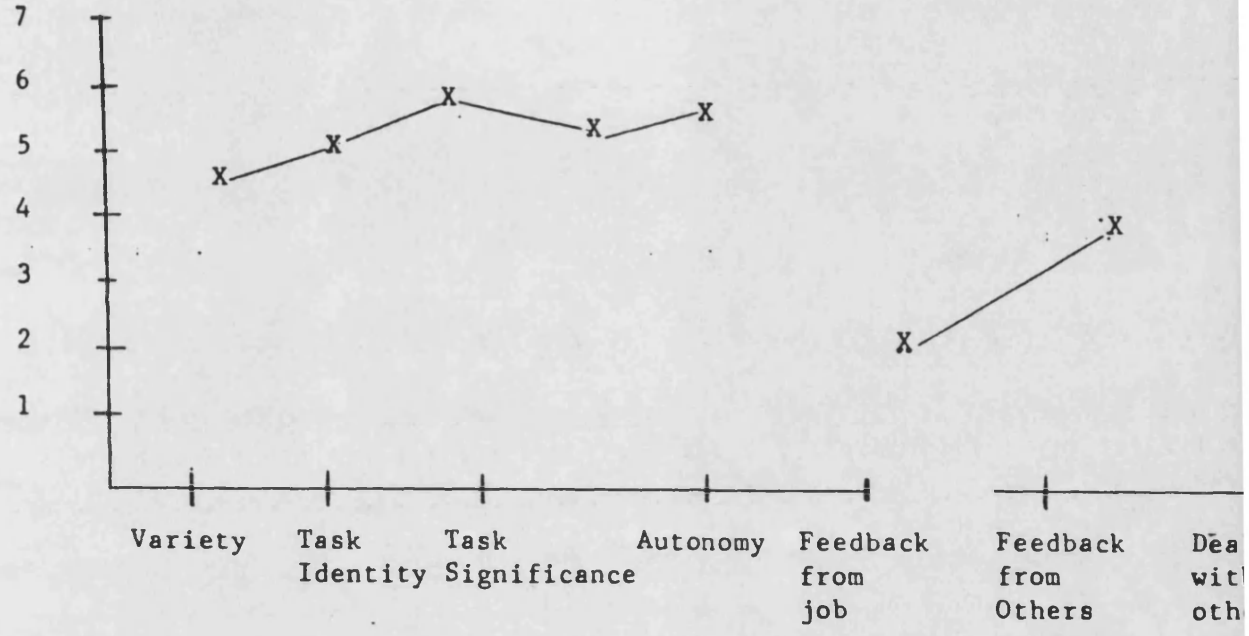
Supervision

These views are broadly supported by supervisors who feel that it is important to give attention to the human factors involved in the change. As regards their own role with the involve already established with the operators in problem solving it is felt that the supervisors own role will be easier and more fulfilling in the new system.

J R S Bailey
10.7.84.

APPENDIX5A.

Summary of key job characteristics
and profile, Paint Sprayers - Autonumis



ref.1. Hackman & Oldham. Job Diagnostic Survey.

TEACHING COMPANY SCHEME

Report on follow-up survey and discussions with Paint Sprayers following installation of Automated Paint Spraying Systems employing a robot

Background

With the agreement of the Company, a survey was carried out in the summer to assess the attitudes of the paint sprayers to their jobs at the time and how they felt they might be affected by the new system (see paper dated 10.7.84). From this survey it appeared that while the operators would welcome the new system for the improvements in hygiene and working conditions that it would afford there was concern expressed at the potential loss in job satisfaction as a result of the robot and automation.

The survey showed that despite the working conditions people experienced a considerable degree of job satisfaction from their feeling that the job was important that they could exercise some degree of discretion as to how they did the job. Also they obtained direct feedback on the quality of their own work.

In the new situation they feared a loss of variety and demand for their skills. The job would be predetermined and they would not feel involved in the total task. Also in the new system they feared that they would not obtain the feedback on quality that they experienced at the time.

Their preference, which coincided with management's own views, was that a system of job rotation would help to overcome some of these deficiencies and help to restore some of the variety and sense of the involvement in the total task that they had been accustomed to.

Introduction of new system

Following regular meetings with the consultants the new system was installed during the shut down and apart from initial problems in getting the robot working, production commenced early August. At this stage, apart from some disillusionment with the robot, the operators co-operated with whatever was necessary to keep production going and a lot of hand spraying was required to compensate for the robot.

The consultants were for a quite long period absent from the scene and some difficulty was experienced in getting their assistance in getting the new system operating effectively. However the Supervisor and the L/H got involved in sorting out the programming problems themselves.

In the meantime, the staffing on the line had been reduced to 4 + a L/H and Supervisor as opposed to the 14 people previously employed (on a 2 shift basis). At this stage no group approach to work organisation had emerged and job rotation had not been initiated, one person being 'stuck on unloading for 10 days at a stretch'. It was also proposed by the Company that one person should be employed on inspection in order to monitor the standard required rather than everybody being involved in achieving the quality standard.

Effect of new system on Job Content

While clearly successful in economic and technical terms there appears to have been a marked deterioration in the quality of work experienced by people in the new system both for operators and supervisor alike and this has led to a decline in morale.

For whatever reason no system of job rotation has been implemented and the operators are confined to what they feel are 'mindlessly boring' jobs. Several people commented that they could not believe how slowly time was passing, and that when they thought it was lunch time it was still only 10.00 o'clock in the morning. They find the standing around very tiring on the legs and with one accord would all prefer to be spraying despite the physical conditions. The operators themselves feel that the new system is no quicker and that the robot is not touching up properly.

These views are to a large extent echoed by the Supervisor who also finds that all interest has gone out of the job. He resents the fact that he is now denied involvement with maintenance and programming aspects of the new system which were in fact a source of new interest and skills.

Although there are some variations in this response e.g. from the person doing the tacking compared to the loading job, it is generally felt that this is an undesirable situation and that people's attention inevitably wanders with consequent dangers for safety and for the quality of the work.

Changes in Job Control

A detailed analysis of the changes shows a significant deterioration on all motivational job characteristics (see Appendix I).

In terms of variety there is now no choice of the components to be sprayed as this is determined by the computer. Task Identity has also decreased because nobody is now involved in the total task. Discretion has also declined because whereas before people would determine their own pace of work this is now dictated by the speed of the track over which the operators have no control. Similarly on the question of feedback whereas an individual could derive feedback on the quality of his work they now feel it doesn't matter.

Although the person working on degreasing feels he has some contact with other people, the other operators feel relatively isolated in their position on the line and satisfaction with the social aspects of the job has fallen quite significantly.

Employee reaction to the new situation

Unfortunately, whereas people went into the change with an open mind, employee reactions to the new system are not very favourable. Some people expressed the view that it would be better if the line were totally automated as their jobs at present could be performed by 'monkeys'. It would certainly appear that in most cases the people employed on the new line were over qualified for the work that they are now doing and will seek the earliest opportunity for transfer or alternative employment unless some changes are made.

Conclusions

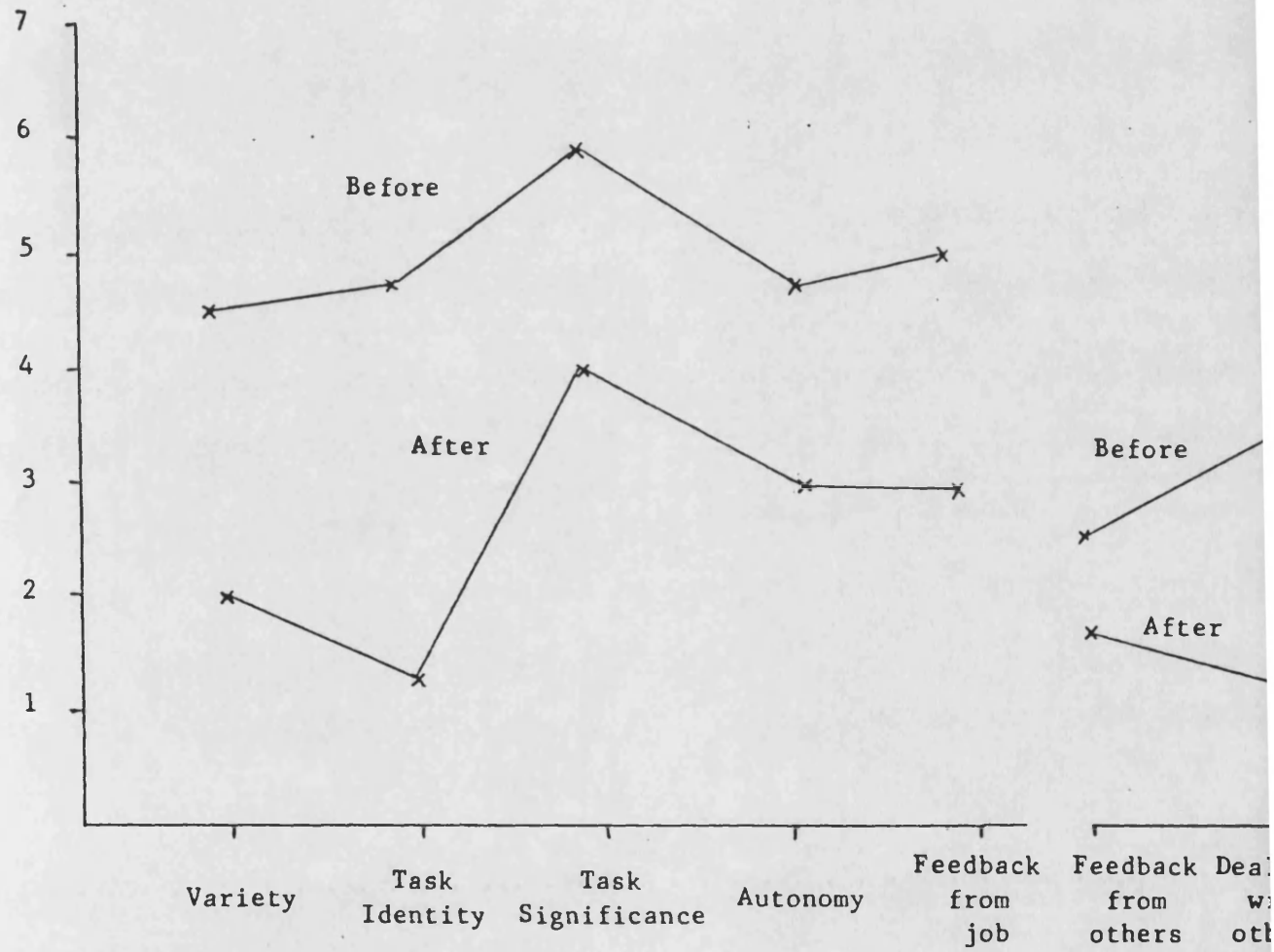
It would appear to be important that management are aware of these problems because although in many respects the new system is working satisfactorily if there is resentment this may not only affect quality and performance on this line but could make further introduction of this type of change more difficult in the future.

J. R. S. Bailey

29.11.84

APPENDIX

Changes to job characteristics/profile of Paint Sprayers as a result of Automation



Working Paper No. 3

Computerisation of an Order Office

1. INTRODUCTION

In this paper a study is made of the impact of changes to the work of people in an order office as a result of changes in organisation and the introduction of a computer based order entry system.

Having reviewed the background to and reasons for the changes the new system and organisation are described. Using job design diagnostic instruments an assessment of the impact of these changes on the content and characteristics of the jobs is made.

Finally the paper examines the approach adopted to the introduction of the changes and observations and conclusions are drawn on the implications of human factors in the introduction of technological change.

BACKGROUND

Ushers Brewery are part of Watney Mann & Truman Brewers Ltd are situated in Trowbridge, Wilts. In 1979 as part of a project on increasing efficiency through employee involvement the Distribution Department was restructured into four zones. Each zone was staffed by a team of 15 Drivers, a Telesales girl and a Load Planner all serving regular customers. The object of this exercise which involved considerable participation of the part of the staff was to improve customer service, thereby maintaining sales in a highly competitive market.

This change was felt to be very effective at the time leading to considerable improvements in customer service, cost reduction, job satisfaction, teamwork and industrial relations.

Since 1979 with the continuing recession trade has remained virtually static while costs and competition have continued to increase. In order to combat this the company felt that rationalisation of the distribution function was essential in order to reduce delivery costs.

These changes coincided with a decision at national level to computerise the order entry system and a Sales Order Processing system was introduced in March 1984.

The New System

The new system based on a Data General NV_{8000} provides the following functions:

1) Order taking - customers' order details keyed straight into system
2) Load planning - records delivery note number and enters it on programme
3) Delivery confirmation - confirmation of exact deliveries made on corrected delivery note
4) Post Delivery Order entry - keys orders back in.
5) Stock recording - records changes in stock levels on continuing basis.

Each Telesales girl has her own VDU screen and a list of customers with basic data as to his address and 'phone number. They are also provided with the customer order history for the last 6 weeks thus enabling them to check his current level of stocks and what additional potential orders he may require. Orders when received are immediately keyed into the system and printed out on a delivery note in load planning.

The system was developed centrally at the London Head Office as a package to be used throughout the Group. There was little if any adaption of the system to suit local circumstances and as the Customer Service Manager said we had to make the package work for us.

4. Re-Organisation of the Department

As with computerisation the aim of the rationalisation of the Distribution department was to reduce costs while maintaining the level of service to the customer.

The concept of zones was abandoned on the grounds that it led to inflexibility of labour and unequal work load between the zones.

Depots cost money in terms of wages and stocks and the 9 depots in the region were reduced to 4 which it was felt would ease stock control. Now the trunkers have to serve 3 depots.

The number of Drivers was reduced from 64 to 41, removing the 3rd man and employing a larger vehicle with a capacity of 9 tons.

Originally there were 4 load planners, one to each zone. They have now been reduced from 4 to 1 the latter being in control of the whole area, thus it was felt improving flexibility.

As regards the Telesales Girls, the previous structure meant that they each dealt with any of a number of promotions or types of sales activity. This it was felt led to inefficiency and people making mistakes. Now the full-time Telesales girls have been replaced by part-timers who by working in the morning are able to get all the orders in before lunch. This helps load planning by making all the afternoon available to plan the following day's deliveries.

A Working Party was set up for the reorganisation at Trowbridge and since then Saturday morning problem solving sessions have been introduced with the Drivers. Distribution Management felt that the involvement of people in target setting, decision making and feed back on achievement and how well they have done has paid off.

6. Changes in Job Design and Work Organisation

With increasing competition and the costs of sales representatives the like other industries have recognised the contribution that telephone selling can make to increased sales. In recruiting new part-time staff for the Telesales Department preference was given to people with previous experience of teleselling and/or the use of computers. Thus in assessing the impact of the changes in the system one must take into account the changed orientation of the operation from customer service to selling.

A further factor is that the girls are now employed on a part-time basis and at a higher grade. Thus although there may be changes in the nature of the job these are to some extent compensated by the more convenient hours and their relatively high levels of earnings.

A further factor affecting the nature of the jobs has been the appointment of a Telesales supervisor who is responsible for dealing with the queries and problems that may arise. The girls are encouraged to pass these on rather than deal with them themselves because it may distract them from the sales task.

There has therefore been a considerable change in the nature of the job from a Customer Service orientation to that of a Tele-sales Operator working with a machine. The girls feel that there is greater pressure on them in terms of time and to some extent in pacing effect. There is now greater emphasis on financial reward as a means of motivation and achieving higher sales through the various promotions that are introduced.

However it is felt by both management and the staff themselves that the computer does enhance and increase the effectiveness of the Tele-sales operators in a number of ways. Apart from the ready access to data about individual customers they are as previously mentioned able to call up the history of

a customer's last 5 weeks orders thus helping them to check their current stocks and what additional orders he may require.

Most of the staff concerned have now come to view the computer as a distinct asset and view it positively rather than as a threat. Many see it as an extension to their own elbow and say that it is only their 'pen and paper'.

Work Organisation

In terms of work organisation with the new system the emphasis has been one of specialisation both horizontally and vertically. There is now very little contact with the Load Planner and the Drivers. In fact the girls are actively discouraged from contacting the Drivers who it is felt will be a distracting influence. Similarly as already mentioned with the appointment of a supervisor the girls do not have the opportunity to be involved in dealing with problems or queries which it is felt may detract from their selling task.

Job Content/Design

Bearing these factors in mind how has the introduction of the new system with the form of work organisation chosen affected the characteristics of the jobs and the inherent motivational factors involved.

To assess this use was made of the Job Diagnostic Survey developed by Hackman & Oldham (2) which was (2) Hackman J. R. & Oldham G. R. (1975) Developing Job Diagnostic Survey, Journal of Applied Psychology 60(2) 159-170, and in the earlier survey of the zoning structure. This survey, based on questionnaires and interviews, assesses employee's reaction to their job in terms of the key motivational characteristics (See Appendix A) Thus in terms of Job Content for example it assesses employee's reaction to the degree of variety, task identity and significance, autonomy and feedback present in their jobs. While in terms of Social Factors it

assesses the extent to which the job involves dealing with and receiving feedback from other people.

These factors have been assessed for the Tele-sales girls in Appendix B which shows the assessment before and after the introduction of the zoning structure and following the recent re-organisation and computerisation of the department.

Job Content

1) Variety

On the question of variety the girls do acknowledge that 'they have to do other things' and 'cover for other people'. They also say that 'shops are different from pubs' and that 'one day is different from another'. The introduction of new products and promotions is very important in terms of increasing their variety but overall particularly in comparison to the zoning structure where they were often involved in load planning their assessment of variety is lower (see Appendix B). It was said that the job is 'limited and monotonous' and that one is 'doing the same thing the whole morning'. Also it was felt that the computer and the pressure of time limits the amount of variety possible.

2) Task Identity

In terms of Task Identity the girls do not now feel involved in the total task and their assessment of this factor is rated at 2.3 as opposed to 3.5 with the zoning structure. They feel that they are not involved in planning and do not see the end result, perhaps partly because they do not receive confirmation that the deliveries have been made.

3) Task Significance

They rate the significance of their jobs very highly at 5.8 with the direct contact with the customer that the job involves. They recognise

the importance of their functions and the fact that without the orders no one would have a job to do.

4) Autonomy

Although the girls feel that they represent the company and decide how to approach the customer on the phone they feel that overall they have relatively little opportunity to use their discretion or make decisions. This is partly due to the computer that provides the necessary information and instructions but also due to the existence of the supervisor who deals with the problems that arise.

'What I have to do is dictated to me; there is no flexibility at all.'

'No control over what happens, when customers come on they feel you don't care.'

'Basically told what to do; can make some decisions about deliveries.'

5) Feedback

Feedback is rated quite highly, particularly as the girls feel they get direct feedback from the customer. However they do feel that there is a long time from the delivery to the customer and confirmation going into the machine. Also because they don't see the Delivery notes they feel they 'don't know what's happened to a load after its left'.

Social Factors

As already mentioned the girls appreciate the direct contact and feedback from the customer and they feel the job does involve contact with sales and beer service. They feel there is evidence now of more cooperation between departments helped by the monthly meetings.

However basically they feel that the job is a 'bit isolated and that they feel like a 'cog in the wheel'. They would like to have more personal contact with customers. They are conscious of the

have their own customers and that there is a need to build up the relationship. They also feel that there is a need for more team work and to get to know other members of the team e.g. the Drivers and Sales Representatives.

Partly perhaps as a consequence of this relative isolation they feel that they get little feedback from others within the organisation, for example from either load planning or the Drivers. In addition there is a suggestion that there is little feedback from management, only if something goes wrong.

Other issues

While there is a general acceptance of the new computer system the girls are concerned about the increasing number of manual surveys and paperwork exercises that they are having to complete. They feel there are so many forms that there is no time for sales and that they are 'bogged down with paperwork'. There were at the time of the survey four different forms that they had to fill in and this they felt defeated the object. If these surveys are really necessary they feel that they could be done on the computer and that the company was not fully utilising the computer's capability.

Summary

The overall assessment of the changes to the Tele-sales operators' jobs must be made against the changed emphasis on sales and against their employment conditions. While in general the staff welcome the computer with its more ready access to and handling of information they feel that they are still involved in a lot of form filling by hand that it should be possible to computerise. The job as a result of computerisation has become more routine and pressurised. With the form of work organisation chosen the jobs are more isolated and provide less scope for use of discretion.

However despite the fact that the girls are part-timers their general level of expectation of their work, in terms of interest and satisfaction is quite high (5.2 on a scale of 1-7) and therefore a number of people find that the work is rather tedious and monotonous.

This has however to some extent been compensated by the interest created by promotions, the challenge of selling and the satisfaction of achievement and undoubtedly the role of the supervisor in training the staff and holding problem solving sessions has greatly enhanced this.

7. CONCLUSIONS

Change in distribution and the order office was a necessary response to changing circumstances in the external market environment in which the firm was operating. The need to reduce distribution costs and increase sales prompted a move towards greater specialisation of tasks and centralisation of control together with the use of new technology to increase efficiency and speed of formation handling.

In terms of results against the objectives considerable savings have been made in terms of reducing costs in distribution and while the level of service is acknowledged not to be as high as with the zoning system against planned deliveries of 98%, a 97% average service level has been achieved.

The computer system does appear to be working well and has been accepted and welcomed by the staff although its use could be extended to encompass some of the other routines and returns that the Tele-sales girls are increasingly required to fulfil.

It is not clear how far the effect on the jobs of the people concerned was considered at the time the computer system was designed or how the decisions about the organisation of work in distribution were made.

However, although compensated to some extent by the advantages of the computer, changed working conditions and a sales achievement orientation these benefits appear to have been achieved at some cost to the job satisfaction and sense of involvement of the staff.

8. Issues and questions for discussion

There are a number of issues that this case study raises relating to the introduction of such new systems and the form of work organisation chosen.

i) While the development of such a system centrally clearly achieves savings in development costs is it necessary for all the i's to be dotted and t's to be crossed before being implemented locally. Would it not be possible for some areas of discretion and choice to be built into systems to encourage involvement of local people in designating a system to suit their circumstances?

ii) Does the trade off in terms of increased efficiency compensate for the apparent loss in customer contact from the new system. Although service levels remain relatively high what is impact of the more impersonal telephone sales system on the customer and his willingness to order.

Does the trade off in flexibility and reduced costs of the new system compensate for the reduced level of customer contact, i.e. what are likely to be longer term effects?

iii) Were there options and alternatives available in terms of work organisation when new computer system introduced? Does not the computer with easy access to shared information enhance the possibilities of team work? Could not a team of ~~Dr~~ Telesales girl and load planner have access to a V.D.U. in order to plan their own approach to managing sales and improving deliveries in their own area?

iv) Could the system not be designed to give the operator more control? Why is there a loss of contact with others in the team? Who made these decisions, where and when? How far for example were these options dictated by the design of the technical system and what criteria were taken into account at this stage?

v) How far in the development of the system could it have been possible to build in features that enhanced variety, autonomy and feedback for the staff, e.g. by determining their own calling pattern and by providing information of delivery?
Note that while the jobs in the new computerised structure scored less on motivational factors in comparison to original specialised structure, computerisation improved a number of the characteristics namely Variety, Task Significance and Feedback.

vi) Promotional bonuses while providing an incentive create a lot of friction. If staff were really involved and motivated to serve the customer would a bonus be necessary?

Appendix A

KEY MOTIVATIONAL JOB CHARACTERISTICS

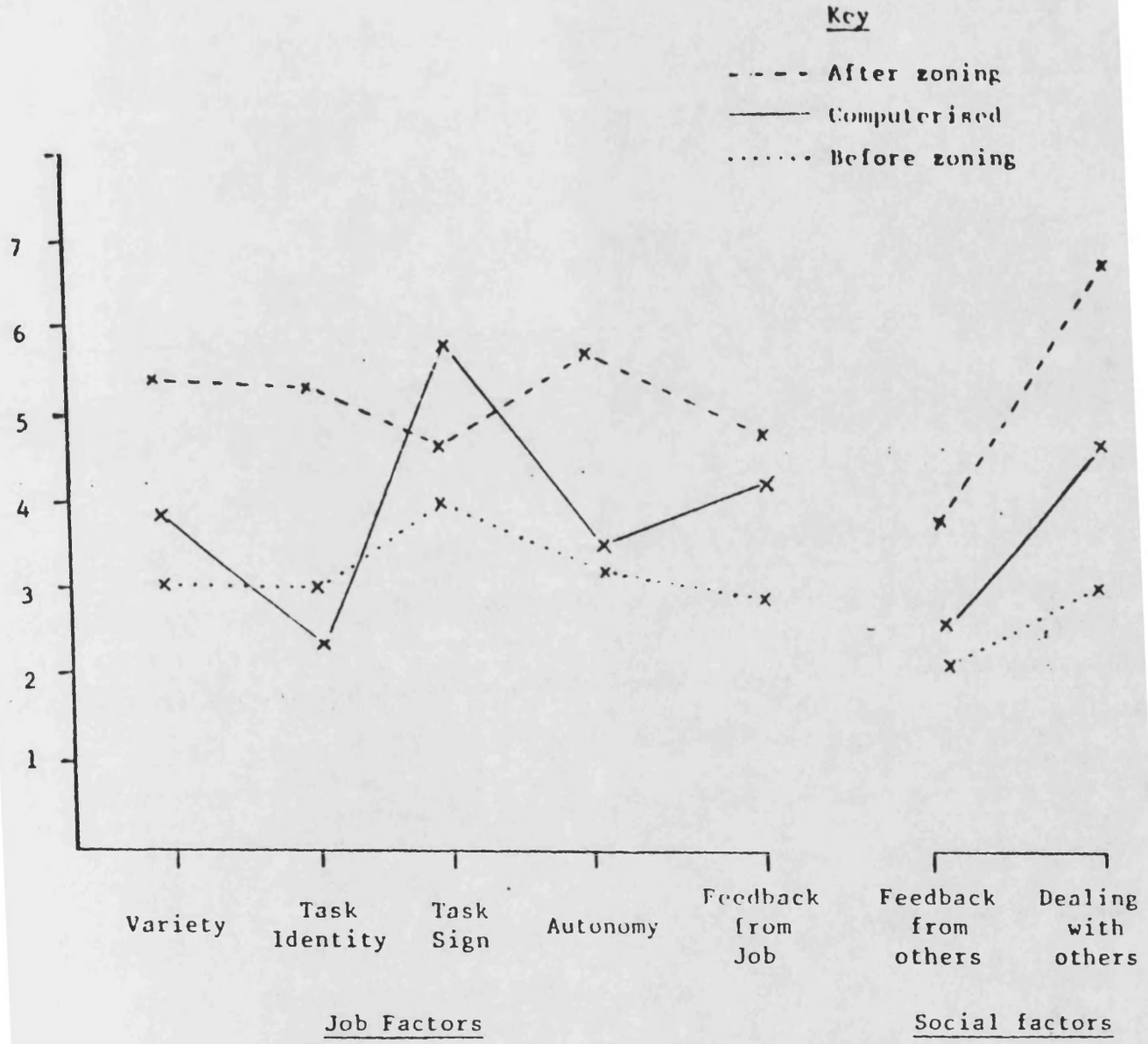
VARIETY	the variety afforded by the job in terms of activity or skills required.
TASK IDENTITY	a sense of doing a whole job from beginning to end with a visible outcome.
TASK SIGNIFICANCE	the perceived impact of the job on the lives or work of other people.
AUTONOMY	the degree of freedom, independence and discretion in planning and organising their own work.
FEEDBACK	the extent to which the job provides feedback on the effectiveness of their own performance.

Other factors affecting sense of involvement and satisfaction

DEALING WITH OTHERS	degree of involvement with others and sense of team work.
FEEDBACK FROM OTHERS	feedback and support received from supervision and and others.

Reference: Hackman J. R. & Oldham G.R. (1975)
Developing Job Diagnostic Survey, Journal of Applied Psychology 60(2), 159-170.

Appendix B



CHARACTERISTICS OF TELEPHONE SALES OPERATORS' JOBS AS A RESULT OF CHANGES IN ORGANISATION AND COMPUTERISATION

APPENDIX "8"

Suggested questions:

- ❑ What do you do?

- ❑ What are the significant working relationships that you have
  - within your group?
  - outside your group?

- ❑ What are some of the things that help you do a good job for customers?

- ❑ What gets in the way of doing a good job for customers?

- ❑ *Do you feel you have enough responsibility in your dealing with customers?

- ❑ *Do you get told enough about what's going on and why?

- ❑ *What would you like to know more about, and who should be telling you?

- ❑ *Do you feel you have enough say on the way things are done?

- ❑ *In what ways do you feel you could be involved more
  - on what?
  - by whom?

- ❑ *Is it any different working in District/CSE/etc than it was in the old Telephone Area?
  - If so, how?

* **(Follow up to get more specific information)**

QUESTIONNAIRE

Scale for Questions 1-10

1. There's **none** of that in my job
2. There's **just a little** of that in my job
3. There's a **moderate amount** of that in my job
4. There's **quite a lot** of that in my job
5. There's **a great deal** of that in my job

How much do you feel each of these features is present in the current job you do:

Q.1 The freedom to choose you own method of working — 1 2 3 4 5

Q.2 The amount of responsibility you are given — 1 2 3 4 5

Q.3 The recognition you get for good work — 1 2 3 4 5

Q.4 Being able to judge your work performance, right away when actually doing the job — 1 2 3 4 5

Q.5 Your opportunity to use your abilities — 1 2 3 4 5

Q.6 The amount of variety in your job — 1 2 3 4 5

Q.7 Your chance of promotion — 1 2 3 4 5

Q.8 The attention paid to suggestions you make — 1 2 3 4 5

Q.9 The feeling of doing something which is not trivial, but really worthwhile — 1 2 3 4 5

Q.10 Doing a whole and complete piece of work which contributes to the work of Business Systems Unit — 1 2 3 4 5

Q.11 In your current job, what helps you provide a good service to customers?

Q.12 In your current job, what gets in the way of providing a good service to customers?

Q.13 How do you expect CSS will change your job?

Q.14 From what you know of CSS how do you think it will affect service to customers?

Q.15(a) Is there anything you've tried to change to make your job more satisfying?

YES ☐ No ☐

(b) If YES, what?

(c) What happened as a result?

Q.16 To what extent do you feel informed about progress on CSS?

To a very great extent	☐
To a great extent	☐
To some extent	☐
To a little extent	☐
Not at all	☐

Q.17 To what extent do you feel you've personally been involved in bringing in CSS?

To a very great extent	☐
To a great extent	☐
To some extent	☐
To a little extent	☐
Not at all	☐

Q.18 In which aspects of bringing in CSS do you feel you could have contributed more?

Finally, to help with CSS/ODG's analysis please note your grade and job title below:

Thanks for your help.

APPENDIX 9 SCORES FROM HACKMAN AND OLDHAM SURVEY

Table 1 - Scores on Job Characteristics (Ref. Hackman and Oldham1980) at Normalair Garrett after computerization

FACTORS	SCORES									TOTALS	MEANS
	1	2	3	4	5	6	7	8	9		
Variety	5.0	5.5	5.5	6.5	4.0	6.0	7.0	6.0	6.0	51.5	
	6.0	6.0	7.0	7.0	3.0	6.0	7.0	5.0	7.0	54.0	
	7.0	3.0	3.0	6.0	3.0	4.0	6.0	6.0	5.0	43.0	
										148.5	**5**
Task Identity	7.0	4.0	4.0	7.0	5.3	6.5	7.0	7.0	7.0	55.0	
	7.0	7.0	2.0	2.0	6.0	7.0	7.0	7.0	7.0	52.0	
	7.0	1.0	7.0	6.0	2.0	7.0	7.0	6.0	7.0	50.0	
										157.0	**5.8**
Task Significance	4.0	4.0	-	6.0	6.0	2.5	5.0	4.0	5.0	36.5	
	7.0	3.0	6.0	3.0	7.0	1.0	6.0	4.0	5.0	42.0	
	7.0	6.0	6.0	7.0	7.0	1.0	7.0	6.0	2.0	49.0	
										127.0	**4.7**
Autonomy	2.0	3.0	6.0	7.0	4.0	7.0	4.5	5.3	6.0	45.0	
	7.0	5.0	7.0	2.0	2.0	6.0	7.0	7.0	6.0	49.0	
	5.0	7.0	5.0	7.0	7.0	3.0	7.0	7.0	7.0	55.0	
										149.0	**5.5**
Feedback	6.0	7.0	2.5	3.0	5.5	7.0	6.0	6.0	6.0	49.0	
	6.0	6.0	6.0	6.0	5.0	5.0	6.0	5.0	6.0	51.0	
	2.0	6.0	5.0	3.0	6.0	3.0	7.0	6.0	7.0	45.0	
										145.0	**5.3**
Working with others	5.0	5.3	1.0	4.0	6.6	2.5	6.0	7.0	6.0	43.6	
	6.0	6.0	7.0	5.0	7.0	5.0	1.0	6.0	6.0	49.0	
	5.0	3.0	7.0	6.0	2.0	2.0	2.0	2.0	6.0	35.0	
										127.6	**4.7**
Feedback from others	5.5	4.0	3.0	4.0	5.0	3.0	5.5	7.0	5.0	42.0	
	4.0	6.0	5.0	6.0	6.0	2.0	6.0	5.0	5.0	45.0	
	6.0	7.0	3.0	6.0	6.0	2.0	7.0	7.0	7.0	51.0	
										138.0	**5.0**

Table 2 - Scores on Job Characteristics (Ref. Hackman and Oldham1980) at Autonumis Paint Spraying Department after computerization

FACTORS	SCORES				TOTALS	MEANS
	1	2	3	4		
Variety	1.0	2.0	2.0	2.0	7.0	
	1.0	2.0	1.0	1.0	5.0	
	5.0	3.0	1.0	3.0	12.0	
					24.0	**2.0**
Task Identity	1.0	1.0	3.0	3.0	8.0	
	1.0	1.0	1.0	1.0	4.0	
	1.0	2.0	1.0	1.0	5.0	
					17.0	**1.4**
Task Significance	1.0	2.0	5.0	5.0	13.0	
	5.0	5.0	1.0	3.0	14.0	
	5.0	5.0	7.0	3.0	20.0	
					47.0	**3.9**
Autonomy	1.0	1.0	2.0	4.0	8.0	
	5.0	1.0	4.0	7.0	17.0	
	2.0	1.0	3.0	5.0	11.0	
					36.0	**3.0**
Feedback	1.0	2.0	2.0	4.0	9.0	
	4.0	1.0	2.0	2.0	9.0	
	4.0	7.0	6.0	2.0	19.0	
					37.0	**3.0**
Feedback from others	1.0	1.0	2.0	2.0	6.0	
	5.0	1.0	1.0	5.0	12.0	
	1.0	1.0	1.0	3.0	6.0	
					24.0	**2.0**
Dealing with others	1.0	1.0	2.0	4.0	9.0	
	1.0	1.0	1.0	2.0	5.0	
	2.0	1.0	1.0	1.0	5.0	
					19.0	**1.5**

Table 3 - Scores on Job Characteristics (Ref. Hackman and Oldham1980) at Ushers, Distribution Depot after computerization

FACTORS	SCORES							TOTALS	MEANS
	1	2	3	4	5	6	7		
Variety	4.0	3.0	2.0	2.0	5.0	2.0	4.0	22.0	
	3.0	2.0	4.0	2.0	7.0	3.0	3.0	24.0	
	2.0	5.0	2.0	4.0	4.0	3.0	6.0	26.0	
								82.0	**3.9**
Task Identity	4.0	5.0	2.0	1.0	4.0	2.0	3.0	21.0	
	3.0	7.0	2.0	1.0	7.0	6.0	1.0	27.0	
	2.0	1.0	2.0	1.0	1.0	2.0	1.0	10.0	
								58.0	**2.3**
Task Significance	5.0	4.0	5.0	5.0	7.0	6.0	5.0	37.0	
	7.0	7.0	6.0	7.0	7.0	6.0	6.0	46.0	
	7.0	5.0	7.0	6.0	4.0	6.0	5.0	40.0	
								123.0	**5.8**
Autonomy	4.0	4.0	3.0	3.0	4.0	5.0	2.0	25.0	
	3.0	3.0	2.0	3.0	6.0	5.0	2.0	22.0	
	3.0	7.0	3.0	2.0	5.0	7.0	3.0	30.0	
								77.0	**3.6**
Feedback	6.0	5.0	3.0	4.0	4.0	5.0	4.0	31.0	
	6.0	3.0	3.0	2.0	3.0	6.0	5.0	28.0	
	7.0	6.0	5.0	2.0	2.0	6.0	5.0	30.0	
								92.0	**4.38**
Feedback from others	4.0	2.0	2.0	1.0	2.0	6.0	2.0	19.0	
	3.0	2.0	3.0	2.0	2.0	3.0	3.0	18.0	
	7.0	1.0	3.0	2.0	2.0	6.0	3.0	24.0	
								61.0	**2.9**
Dealing with others	4.0	6.0	6.0	2.0	7.0	7.0	7.0	39.0	
	6.0	6.0	6.0	6.0	7.0	3.0	6.0	40.0	
	2.0	6.0	6.0	5.0	3.0	2.0	6.0	30.0	
								109.0	**5.0**

SCORING KEY FOR THE JOB DIAGNOSTIC SURVEY

The Job Diagnostic Survey (JDS) measures several characteristics of jobs, the reactions of the respondents to their jobs, and the growth need strength of the respondents. Each variable measured by the JDS is listed below, along with (a) a one or two sentence description of the variable, and (b) a list of the questionnaire items which are averaged to yield a summary score for the variable.

The JDS is based on a questionnaire originally compiled by Hackman & Lawler (Employee Reactions to Job Characteristics, Journal of Applied Psychology Monograph, 1971, 55(3), 259-286). A complete description of the JDS is provided by Hackman & Oldham (The Job Diagnostic Survey: An Instrument for Diagnosing the Motivational Potential of Jobs, Technical Report No. 4, Department of Administrative Sciences, Yale University, 1974). The theory on which the JDS is based is described by Hackman & Oldham (Motivation Through the Design of Work: Test of a Theory, Technical Report No. 6, Department of Administrative Sciences, Yale University, 1974).

For further information about the instrument and its uses, contact:

Prof. J. Richard Hackman
56 Hillhouse Avenue
Yale University
New Haven, Ct. 06520

or

Prof. Greg R. Oldham
Department of Business Administration
University of Illinois
Urbana, Ill. 61801

* * *

I. JOB DIMENSIONS: Objective characteristics of the job itself.

A. Skill Variety: The degree to which a job requires a variety of different activities in carrying out the work, which involve the use of a number of different skills and talents of the employee.

Average the following items:

Section One 04
Section Two 01
05 (reversed scoring--i.e., subtract the number entered by the respondent from 8)

B. Task Identity: The degree to which the job requires the completion of a "whole" and identifiable piece of work--i.e., doing a job from beginning to end with a visible outcome.

Average the following items:

Section One 03
Section Two 011
03 (reversed scoring)

C. Task Significance: The degree to which the job has a substantial impact on the lives or work of other people--whether in the immediate organization or in the external environment.

Average the following items:

Section One: #5
Section Two: #3
#14 (reversed scoring)

D. Autonomy: The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling his work and in determining the procedures to be used in carrying it out.

Average the following items:

Section One: #2
Section Two: #13
#9 (reversed scoring)

E. Feedback from the Job Itself: The degree to which carrying out the work activities required by the job results in the employee obtaining information about the effectiveness of his or her performance.

Average the following items:

Section One: #7
Section Two: #4
#12 (reversed scoring)

F. Feedback from Agents: The degree to which the employee receives information about his or her performance effectiveness from supervisors or from co-workers. (This construct is not a job characteristic per se, and is included only to provide information supplementary to construct (E) above.)

Average the following items:

Section One: #6
Section Two: #10
#7 (reversed scoring)

G. Dealing with Others: The degree to which the job requires the employee to work closely with other people (whether other organization members or organizational "clients").

Average the following items:

Section One: #1
Section Two: #2
#6 (reversed scoring)

II. EXPERIENCED PSYCHOLOGICAL STATES: The psychological impact of the job on the employee. These three psychological states are viewed as mediating between objective job characteristics (listed above) and the affective (e.g., satisfaction, motivation) and behavioral (e.g., performance quality, absenteeism) responses of employees to their work. Each of the three constructs are measured both directly (Section Three) and indirectly, via projective-type items (Section Five).

A. Experienced Meaningfulness of the Work: The degree to which the employee experiences his or her job as one which is generally meaningful, valuable, and worthwhile.

Average the following items:

Section Three: #7
#4 (reversed scoring)
Section Five: #6
#3 (reversed scoring)

B. Experienced Responsibility for the Work: The degree to which the employee feels accountable and responsible for the results of the work he or she does.

Average the following items:

Section Three: #8, #12, #15
#1 (reversed scoring)
Section Five: #4, #7

C. Knowledge of Results: The degree to which the employee knows and understands, on a continuous basis, how effectively he or she is performing his job.

Average the following items:

Section Three: #5
#11 (reversed scoring)
Section Five: #5
#10 (reversed scoring)

III. AFFECTIVE RESPONSES TO THE JOB: The private, affective reactions or feelings an employee gets from working on his job. The first two constructs (general satisfaction and internal work motivation) are measured both directly (Section Three) and indirectly (Section Five).

A. General Satisfaction: An overall measure of the degree to which the employee is satisfied and happy in his or her work. (This measure has been shown to predict both turnover and absenteeism--i.e., the lower the satisfaction, the more the turnover and absenteeism).

Average the following items:

Section Three: #3, #13
#9 (reversed scoring)
Section Five: #2
#3 (reversed scoring)

B. Internal Work Motivation: The degree to which the employee is motivated to perform effectively on the job. This measure previously has been shown to relate directly to the quality of the employee's work.

Average the following items:

Section Three: #2, #6, #10
#14 (reverse scoring)
Section Five: #1, #9

C. Specific Satisfactions: These short scales tap several specific aspects of the employee's job satisfaction. They all relate positively to the general satisfaction measure (Construct A above), but the specific satisfaction with "growth" (Scale 5, below) relates most strongly to the characteristics of jobs themselves.

C1. "Pay" satisfaction. Average items #2 and #9 of Section Four.

C2. "Security" satisfaction. Average items #1 and #11 of Section Four.

C3. "Social" satisfaction. Average items #4, #7, and #12 of Section Four.

C4. "Supervisory" satisfaction. Average items #5, #8, and #14 of Section Four.

C5. "Growth" satisfaction. Average items #3, #6, #10, and #13 of Section Four.

IV. INDIVIDUAL GROWTH NEED STRENGTH: These scales tap an individual difference among employees--namely, the degree to which each employee has a strong vs. weak desire to obtain "growth" satisfactions from his or her work. Individuals high on this measure have been shown to respond positively (i.e., with high satisfaction and internal work motivation) to complex, challenging, and "enriched" jobs; individuals low on this measure tend not to find such jobs satisfying or motivating. The questionnaire yields two separate measures of growth need strength, one from Section Six and one from Section Seven.

"Would Like" Format (Section Six)
Average the six items from Section Six listed below. Before averaging, subtract 3 from each item score; this will result in a summary scale ranging from one to seven. The items are:
#2, #3, #6, #8, #10, #11

"Job Choice" Format (Section Seven)
Each item in Section Seven yields a number from 1-5 (i.e., "Strongly prefer A" is scored 1; "Neutral" is scored 3; and "Strongly prefer B" is scored 5. Compute the need strength measure by averaging the twelve items as follows:
#1, #5, #7, #10, #11, #12 (direct scoring)
#2, #3, #4, #6, #8, #9 (reversed scoring)

V. MOTIVATING POTENTIAL SCORE: A score reflecting the potential of a job for eliciting positive internal work motivation on the part of employees (especially those with high desire for growth need satisfactions) is given below.

$$\text{Motivating Potential Score (MPS)} = \left[\frac{\text{Skill Variety} + \text{Task Identity} + \text{Task Significance}}{3}\right] \times [\text{Autonomy}] \times [\text{Feedback from the Job}]$$

APPENDIX 11

REPORT ON INTRODUCTION

OF

INTEGRATED SYSTEMS

OF QUALITY CONTROL

JOHN BAILEY
MARCH 1987

WORKING PAPER 1

ACME/DUPONT

INTEGRATED SYSTEMS OF QUALITY CONTROL

1. INTRODUCTION

The object of this paper is to summarise some of the key issues that have emerged so far from my investigations relating to the development and introduction of integrated systems of quality control employing automated methods.

2. FOCUS

The key focus of my work on this project is how the introduction of more automated methods of quality control will affect the role of management, the organisation structure and the role and contribution of staff employed in the business. How far in the introduction of increased automation is it possible to maintain and enhance the role of staff in achieving improved standards of quality and what is the inter-relationship between the two?

3. RESEARCH ON NEW TECHNOLOGY

Research in this field indicates that the arbitrary introduction of computers in the field of manufacture can frequently reduce the involvement and satisfaction of staff with negative effects both for them but also in relation to the objectives being sought e.g. improved quality.

It is therefore very desirable when introducing these systems to analyse and plan for changes in both the social as well as technical aspects of the system, in short we need to adopt a total/integrated approach. (see Figure 1)

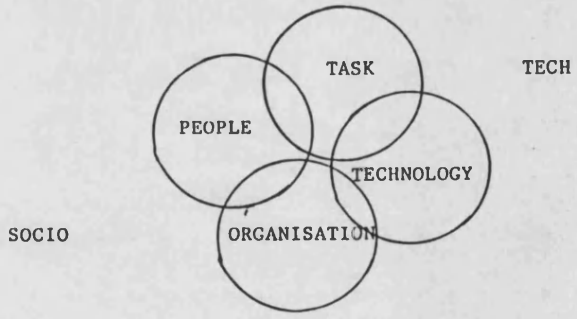


Figure I SOCIO/TECHNICAL SYSTEM

Thus the question of whether the adoption of new technology has a negative impact on people and their involvement may not be so much a question of the technology itself but rather the way that it is introduced.

We need to recognise that there may be choices and alternatives not only in terms of organisation design and the role and contribution of people in the process but also in terms of the technology such that a better fit/match between the two is achieved for the benefit of the organisation and the objectives that they are trying to achieve.

4. KEY FACTORS IN INTRODUCTION OF COMPUTER BASED AUTOMATION

Recent research in this field has indicated that there are a number of key factors which can influence the effective introduction of technology and the ultimate match between people and the technical system concerned. (see Figure II) These include:-

Organisational Culture	-	the philosophy, values and culture of the organisation and its influence on the introduction of new technology.
Management strategy	-	the objectives and reasons for the introduction of new technology e.g. increasing competitiveness or reducing costs.
System development	-	the approach adopted towards system development, the degree of participation in the design process, the extent to which technical and organisational choice and alternatives are recognised and explored.
Organisation structure	-	the extent to which there is recognition of the impact of computer systems on organisation structure and the integration that can be achieved by information technology.
Management style	-	the opportunity created by computer aided automation for a more delegated management style.
Job Design and Work Organisation	-	the opportunities to adopt alternative forms of work organisation e.g. moving from specialised individual jobs to more flexible forms of group working.

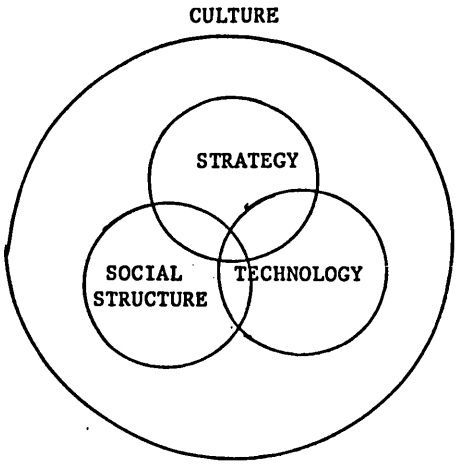


FIGURE II KEY VARIABLES IN INTRODUCTION OF COMPUTER BASED AUTOMATION

5. DUPONT

Information collected so far regarding these factors at Dupont indicate a very positive climate towards the introduction of greater automation and an awareness of the social factors and issues involved.

In terms of the setting the company has sought to develop a distinctive culture and sees further automation as a key factor in their strategic development.

5.1 ORGANISATION CULTURE

The culture of the organisation which has been described as the 'Bristol way' has a number of significant and distinctive features identifying values and beliefs about the way the business should be run. These values and beliefs have been developed 'with and by' the employees themselves and it would appear in consequence that they have a significant influence over attitudes and behaviour within the organisation. (See Appendix A for relevant company papers)

Such features as the emphasis on safety and to operate a profitable business with continuous improvement in quality and service provide overall objectives with which people can identify. Similarly beliefs that management should not be 'top heavy' and won't stand over or police people should help to develop the atmosphere of trust that they are seeking to build. This together with the emphasis on the outward/business role of management (called resources in Dupont) and the strategic contribution of core employees should help to create a favourable climate for the further extension of automation in which people and their contribution will not be threatened.

5.2 STRATEGY

Improvements in the quality of the product and of customer service is seen as a key element in the strategic development of the business. Increased automation and the development of a computer integrated system of quality control is thus a very important means of helping to achieve this objective at a competitive price. However the company also recognises the need for total commitment to quality from employees at all levels and the development of this commitment is seen as an equally important element of the strategy. This recognition of the importance of both technical and social factors in the achievement of improved quality should have a significant influence on the design of the new system and the ultimate match between the technology and people involved.

Similarly, however, apart from technological developments, considerable time and thought has been devoted to social factors in the development of the organisation. Such issues as what type of organisation structure, what style of management and what form of work organisation is desirable and appropriate in the circumstance and environment in which they are operating have been considered.

5.3 ORGANISATION STRUCTURE

The Company has sought to develop 'a low fixed cost and more flexible structure' utilising high spans of management control and self-managing team concepts. The focal points of the organisation are the core modules of assembly, pressing, moulding and material control with management resources supporting the core activities from a functional point of view. The open and organic style of organisation is reflected in the open plan layout in the offices and the relative lack of emphasis on status differences.

With the object of increasing flexibility and responsiveness to change the concept of a flexible work force with core and contract employees has been adopted to help adjust manning levels to changing demands. This is combined with an emphasis on the high added value function of core employees such as assembly and contracting out lower added value non-strategic activities such as pin making.

Thus in concept the organisation is based very much on open socio-technical principles with an emphasis on decentralisation and autonomous business units. It tends towards a flat rather than hierarchical structure with a high degree of delegation, authority and autonomy at the operating level.

In these circumstances there is a greater opportunity for computer based systems of information to be used by employees and the people doing the job

rather than being seen as a means of increasing management control (See Appendix B for approach and illustrative organisation chart.)

5.4 MANAGEMENT STYLE

The intended management style is to some extent reflected in the use of the term 'resource' rather than 'management' for management and professional staff. This emphasises their role in terms of support and facilitators rather than of direction and control. The objective as regards the role of resources is therefore to be less hierarchical, more collegiate/professional, to guide, lead, motivate and referee and to be visible and accessible. The relative lack of emphasis on status differentials is reflected in the fact that all employees are salaried and that employee benefits are harmonised.

This delegate style ofmanagement supports the concept of self management which in itself would further be aided by greater provision of computer based quality control information. (See Appendix C for Resource Functions)

5.5 WORK ORGANISATION AND JOB DESIGN

Work organisation as already mentioned is based on the principle of self managing teams. Each module is defined as an accountable business area with responsibility for their own internal supplier/customer relationships. Emphasis is placed on 'ownership' by the staff of their operations and there is no supervision for core staff as such. Staff (Technician) are therefore responsible for the day-to-day operational management of their functions.

The objective is for complete flexibility and no demarcation between skill lines although the skills required are identified and developed (See Appendix D).

Regarding leadership within the team the intention is for this to be shared on a rotating basis (star leadership pattern) where different members take responsibility for different aspects on a weekly basis. This it is acknowleged requires further development in practice. (See Appendix E)

Research has suggested that where automation and computer based systems of information are introduced in manufacturing the operation becomes more of a continuous process and that in these circumstances changes to the work organisation to match may be required. Thus a move towards flexible group working where a team takes responsibility for the overall operation may be more appropriate. Clearly the provision of more effective feedback and control information on quality performance would much enhance the ability of the team to manage the operation and achieve the desired objectives.

6. NEXT STAGE

The next stage of my investigation on this project is to look more closely at the operation of the self managing teams and the degree of involvement of staff achieved particularly in the field of quality. How far, for example, are the objectives of greater autonomy and flexibility being achieved and what is the current role of staff in relation to quality. What are the attitudes of staff towards increased automation particularly in relation to quality control and how will this affect their role?

The Technicians have been briefed about this next stage of the investigation and are interested in cooperating in any necessary surveys.

JOHN BAILEY
MARCH 1987

DUPONT

COMPANY DOCUMENTS DESCRIBING

OPERATION OF

THE BRISTOL WAY

Core Beliefs

Wants

Way in which we want to run this business (developed with/by technicians)

The Bristol Way

TREAT PEOPLE AS IF THEY WERE WHAT THEY OUGHT TO BE, AND YOU HELP THEM BECOME WHAT THEY ARE CAPABLE OF BEING

* Values the traditional Du Pont beliefs and practices that have produced safety excellence both on and off the job

* Operate a profitable business with continuous improvement in quality and service

* Not 'top' heavy in management

* Won't stand over people or police them

* Develop an atmosphere of trust

* Develop interesting and long term careers for core people

* Provide technician 'ownership' of areas (modules) with responsibility and accountability through self managing teams and individuals

* Team leadership via star model (or other developed rota for duty sharing)

* Technicians run the daily operations, with managers resourcing as necessary

* Develop empathy (understanding of the other person's problem) through appreciation of internal customer/supplier relationship of modules

* Develop a spirit of solid team work, high quality and productivity but still an atmosphere where people enjoy the job and have fun

A DIFFERENT WAY OF OPERATING

PRINCIPLES ESTABLISHED FOR LOW FIXED COST, MORE FLEXIBLE STRUCTURE

- Drive for a high span of managerial resourcing by self managing team concept and processes (ie. drive for minimum managerial levels and headcount)

- Fill only defined high value added and strategic job functions with core employees (where we believe we bring standards of excellence to the functions).

- Develop on site flexible contracting arrangements for non-strategic operational or administrative job functions.

- Utilise other DCS investment and resources where appropriate.

- Outplace low value added / non-strategic manufacture.

- Change inward looking resource focus and culture to an outward looking focus for business support skills.

ORGANISATIONAL APPROACH - KEY FEATURES

Structure

2 Strata

P & M (E)	Managers and Professionals	("Resources")
T & A (NE)	Technicians and administrative	("Ownership boundary")

Environment

T & A (NE)
- Self managing teams via core beleifs/core skill development / "Star" tool for leadership.
- Technicians "own" the plant - run daily operation
- Absolute flexibility, no demarcation between skill lines - yet skill knowledge respected.
- 3 shift rotating system with no supervision on shift (shift patterns developed by technicians).

P & M (E)
- Less hierarchical
  More collegiate / professional
- Resources; Guide; Lead; Motivate; Referee
- Management visible and accessible (open plan)

All employees are salary roll

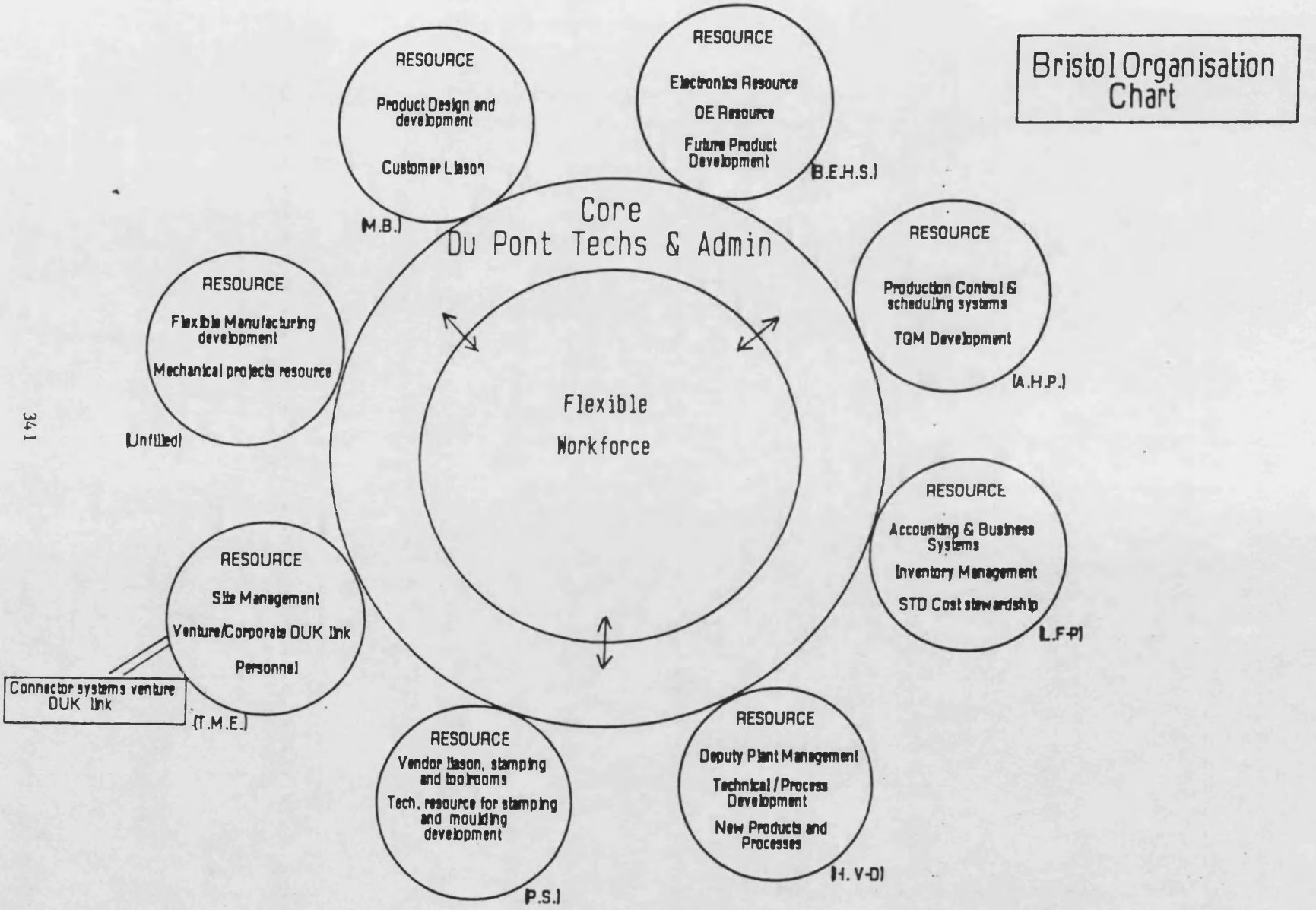
Employee benefits "harmonised"

Modular Approach

Clearly defined semi autonomous 'business' areas

Each module understands internal customer/supplier requirements

Clear association of people with their module needs



Appendix 11b(cont.)

Resource Function

Roll - P & M (Exempt)

Duties

- Focus the energies of the self managing teams (or individuals) tow.. .. ..e business goals/mission for his segment of responsibility

- Set's and gains acceptance of goals/concepts for SMTs (focussed on mission) and audits conformance to these goals and concepts.

- Provides professional resourcing to teams (manufacturing processes/electronics/production/control etc)

- Stimulates/encourages co-operation of individuals to form SMTs. Identifies/discourages "cheaters".

- Referees, provides guidance on contribution assessment of SMTs and key individuals.Forms team with other resources to assess relative contribution of site SMTs/individuals.

- Audits processes for cost conformity, zero defect quality and JIT.

- Audits area of responsibility daily, sets and encourages high professional standards of appearance, housekeeping, and safe working environment, creating an atmosphere of pride and well being in our surroundings.

Contribution

- Resource's contribution very much determined by success of SMTs/individuals they resource in achieving co-operation and energies focussed to goal/mission.

- Resource writes his own mission, focussed on site mission/business goals for his segment.

- Staff hold a 'Coffee Meeting' once a week to share information on activities and briefly discuss general topics. These meetings last as long as it takes to drink a cup of coffee.

Resource Function

Roll - P & M (Exempt)

Duties

- Focus the energies of the self managing teams (or individuals) towards the business goals/mission for his segment of responsibility

- Set's and gains acceptance of goals/concepts for SMTs (focussed on mission) and audits conformance to these goals and concepts.

- Provides professional resourcing to teams (manufacturing processes/electronics/production/control etc)

- Stimulates/encourages co-operation of individuals to form SMTs. Identifies/discourages "cheaters".

- Referees, provides guidance on contribution assessment of SMTs and key individuals.Forms team with other resources to assess relative contribution of site SMTs/individuals.

- Audits processes for cost conformity, zero defect quality and JIT.

- Audits area of responsibility daily, sets and encourages high professional standards of appearance, housekeeping, and safe working environment, creating an atmosphere of pride and well being in our surroundings.

Contribution

- Resource's contribution very much determined by success of SMTs/individuals they resource in achieving co-operation and energies focussed to goal/mission.

- Resource writes his own mission, focussed on site mission/business goals for his segment.

- Staff hold a 'Coffee Meeting' once a week to share information on activities and briefly discuss general topics. These meetings last as long as it takes to drink a cup of coffee.

Self Managing Teams I (Appendix)

Star Model

This is a model which provides a framework for organising people's efforts increasingly in a self-managing way whilst retaining the elements of accountability which are essential in any multi-functional business.

PREMISES

* Many support activities can and should be delegated to the lowest level in the organisation where the knowledge and skills exist.

* Small groups & also ad hoc task forces made up of those people most familiar with the problem / issue can frequently resolve the problem / issue rapidly and effectively.

* The output of the works of self-managing teams has to be focussed towards the greater purpose in alignment with business purpose.

* Accountability is an important element in an efficient organisation.

The star model is a framework which attempts to depict a networking arrangement which provides guidance in organising orderly group roles around some purpose.

The five point of the star indicate the essential activities which have to be attended to in carrying out work towards the purpose.

EG.

What - managing

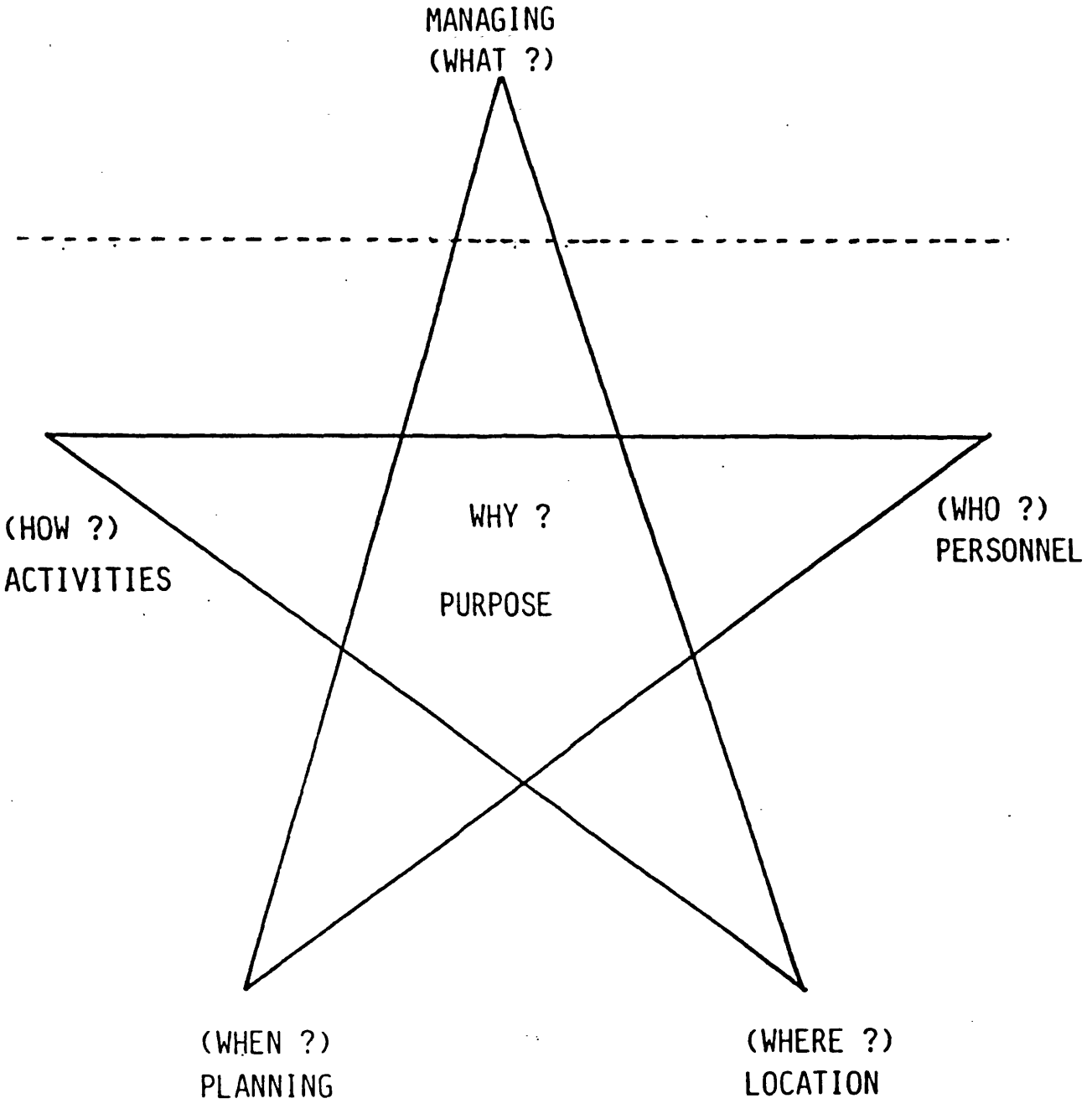
Who - people, personnel

Where - location/environment ; safety, plant, equipment etc

When - planning

How - activities, actions, operations

M O D E L


MANAGING
(WHAT ?)
(HOW ?)
ACTIVITIES
WHY ?
PURPOSE
(WHO ?)
PERSONNEL
(WHEN ?)
PLANNING
(WHERE ?)
LOCATION

A DIFFERENT WAY OF OPERATION

PRINCIPLES

(The Way in which we want to run the Business)

- Values the traditional company beliefs that have produced safety excellence both on and off the job
- Operate a profitable business with continuous improvement in quality and service
- Drive for a high span of control through self managing team processes:
  - Provide technician ownership of areas (modules)
  - Avoid tradictional management structure
  - Won't stand over people or police them
  - Develop an atmosphere of trust
  - Develop a spirit of solid team work, achieving high quality and productivity
  - Develop an environment where people enjoy their work
- Attracts and retains good quality people by offering them interesting jobs and career development where opportunities exist as a competitive remuneration
- Fill only defined high value added and strategic job functions with core employees (where we believe we really bring something to the key functions)
- Develop on site flexible contracting arrangements for the remaining operational or administrative job functions
- Develop empathy (understanding of the other person/s problem) through appreciation of internal customer/supplier relationship
- Lean on other electronics investment and resources where appropriate
- Outplace low value added/non-strategic manufacture
- Change inward looking focus and culture to an outward looking focus for business support skills